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AGRICULTURAL USES OF POWER.
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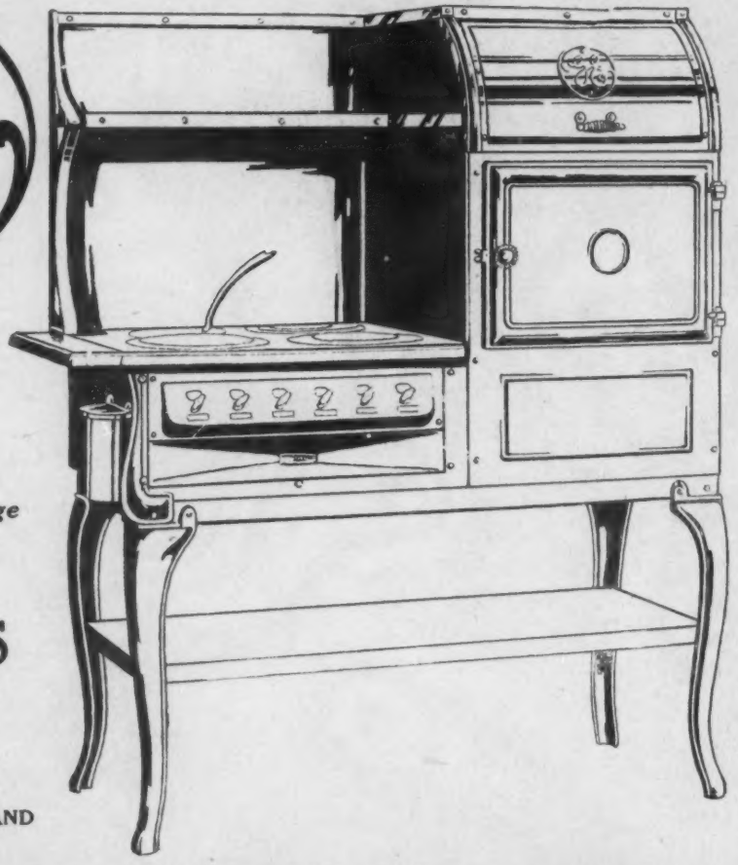

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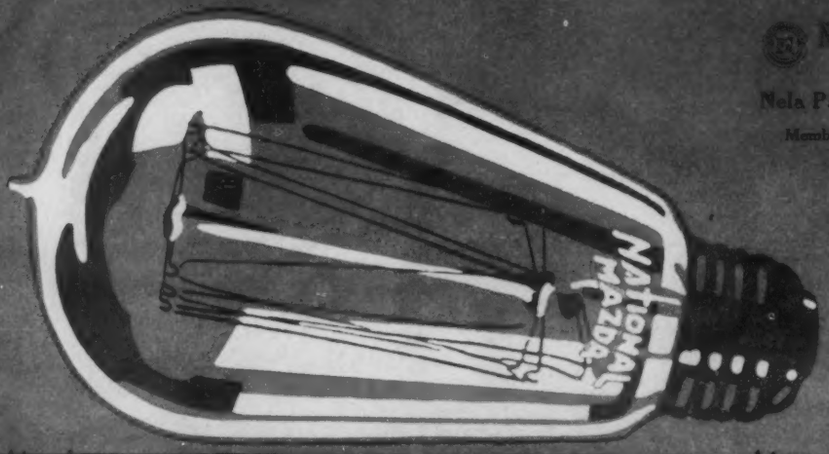

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POWER AND GAS
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What Irrigation Has Accomplished in the San Joaquin Valley.

AGRICULTURAL USES OF POWER

MT. WHITNEY POWER AND ELECTRIC COMPANY'S SYSTEM

BY S. T. HARDING.

In the recent case before the California Railroad Commission involving this company (application No. 1673, Decision No. 3242, decided April 6, 1916) a large amount of data regarding the agricultural use of power was submitted by the Mt. Whitney Power & Electric Company. The following material has been compiled from these exhibits.

The proportion of load of this company used for agricultural purposes is unusually high, as is shown in Table 1.

Table 1—Distribution of Business of Mt. Whitney Power & Electric Company, August 1, 1915.

Character of Use.	No. of Motors.	Total H.P. of Motors.	Per Ct. of Total No.	Per.Ct of Total H.P.
Agricultural	1,666	14,316	66.5	81.8
Domestic	495	758	19.8	4.3
Industrial	298	1,654	11.9	9.5
Railroad	2	375	....	2.1
Miscellaneous	44	397	1.8	2.3
Total	2,505	17,500	100.0	100.0

In view of the fact that the domestic use is largely on farms and that the industrial use is mainly by packing and canning factories, over 90 per cent of the load is directly related to agricultural development. A total of 67,481 acres was irrigated by pumps, whose power was supplied by this system. The distribution of this area among the various crops is shown in Table 2.

Table 2—Acreage of Different Crops Irrigated by Power Supplied by Mt. Whitney Power & Electric Company.

Crops.	Acres.	Acres.	Per Cent of Total.
Citrus bearing	13,498		
Citrus non bearing	14,272—	27,770	41.2
Olives bearing	392		
Olives non-bearing	2,641—	3,033	4.5
Alfalfa		28,890	42.8
Miscellaneous orchards		1,156	1.7
Peaches		1,155	1.7
Vineyards		1,018	1.5
Miscellaneous field crops		4,458	6.6
Total		67,481	100.0

In addition, data were supplied on the installations which were used for either citrus or for alfalfa alone. These plants were all supplied under a flat rate of $50 per horsepower per year. These figures are shown in Table 3. These apply to farms entirely in one crop and have a larger average size than the average for all farms supplied under this system.

Table 3—Average Conditions Under Plants Supplying Only One Kind of Crop.

	Bearing Citrus Orchards.	Non-bearing Citrus Orchards.	Alfalfa.
Acres included	8,388	7,009	17,775
Total horsepower installed	2,150	1,322	2,912
Total tested horsepower	1,816	1,121	2,826
Total annual power bill	$90,798	$56,037	$141,306
Number acres irrigated per horsepower installed	3.90	5.30	6.1
Cost of power per acre per year	$10.84	$7.99	$7.95
Average size of farm—acres	31.5	36.2	68.1
Average horsepower per farm.	8.1	6.8	11.1
Average power bill per average ranch per year	$341.40	$288.85	$538.75

Investigations made by the power company in November, 1914, showed 54 per cent of the load to be supplied under the flat rate of $50 per horsepower per year, 18.1 per cent on the meter rate with a minimum of $24 per horsepower per year and 14.5 per cent on meter rate with a minimum monthly charge of $1 per horsepower installed capacity. The remainder of the load was supplied under various other forms of rates.

The large portion of the load supplied on the flat rate has given this company a high load factor. The company has found by interviews with farmers that most of the plants on this rate are run nearly continuously for a seven-month period. Each farmer installs as small a plant as practicable under continuous operation, in order to reduce the power bill, which depends on the maximum rate of use, instead of installing a

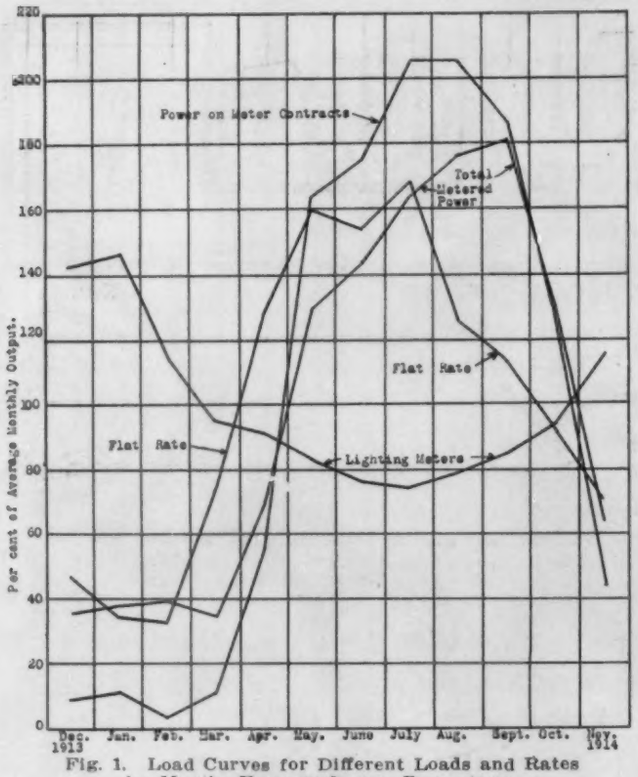


Fig. 1. Load Curves for Different Loads and Rates by Months Expressed as a Percentage of the Average Load.

larger plant and operating intermittently. The motors for pumping give a nearly constant load. A large number of tests has shown the ratio of the average demand to the rated capacity of the motors to be 94.3 per cent. The average annual input per horsepower installed is 3595 kilowatt hours per year delivered at the plant. At the standard rate formerly in use of $50 per horsepower per year, the farmers paid an average of 1.391 cents per kilowatt hour.

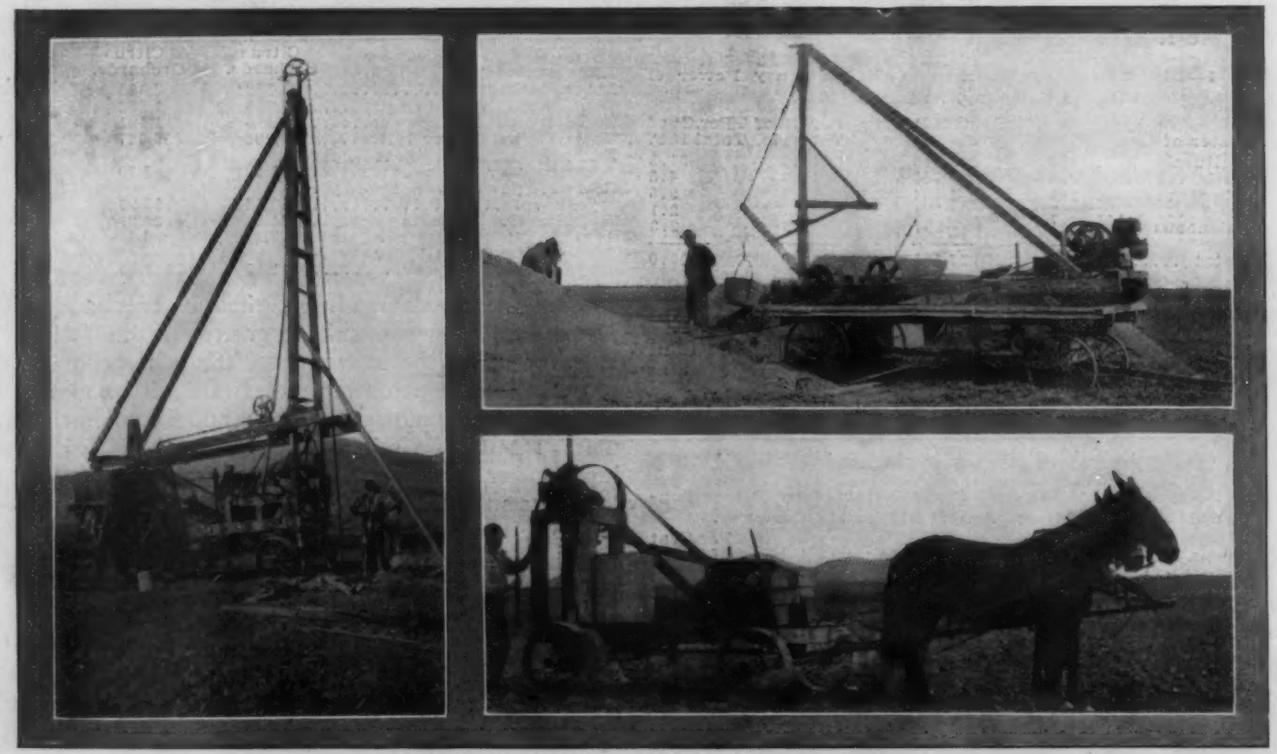
The monthly and annual load factors for 1912 to 1914 are shown in Table 4. April to October are the months of maximum irrigation use. The load factor for each month is the ratio of the maximum use during the month to the mean during the month; that for the year is the ratio of the mamimum use during the year to the mean for the year.

Table 4—Monthly and Annual Load Factor, Mt. Whitney Power & Electric Company.

		Year	
Month.	1912.	1913.	1914.
January	58.3	60.3	61.1
February	48.3	65.2	69.1
March	72.0	74.3	52.7
April	65.9	67.9	70.1
May	63.1	79.3	81.3
June	72.3	74.8	81.7
July	79.0	79.0	90.6
August	79.0	81.8	87.3
September	81.2	84.8	81.1
October	67.9	69.0	70.8
November	68.1	61.6	66.4
December	69.4	63.9	67.8
Year	49.3	49.2	56.4

The load curves for the different forms of rates are shown in Fig. 1. The curve for the flat rate per horsepower year was obtained by deducting the total metered power and lights from 80 per cent of the substation monthly outputs, the remaining 20 per cent being the estimated line losses. The load curves for meter contracts are for all plants in operation for the full year ending May 30, 1914. The load in terms of the per cent of the total monthly output is plotted for each month. The more uniform load curve of the flat rate is quite noticeable.

The seasonal use of power for agricultural purposes as shown under circuits supplying citrus orchards and those supplying alfalfa is of much interest. These were segregated for the motors operating on the flat rate on the lines served by two 6600 volt banks in the Lindsay substation. The metered use was deducted. A 20 per cent estimated line loss was also deducted. The lighting load was insignificant. Over 90 per cent of the irrigation on these circuits



Portable Well Drilling Rigs of Various Types.

was estimated to be for orange orchards. The results are given in Table 5.

Table 5—Use of Power by Motors Operated on Flat Rate on Citrus Orchards.

	Kilowatt Hrs. Per Tested Horsepower.					Hrs. Op'n, O'pd	% Time
Month.	1912.	1913.	1914.	1915.	Av.	Av.	Av.
January	74.4	111.0	30.7	35.0	62.8	85	11
February	100.4	107.6	46.3	83.2	84.4	113	17
March	117.6	135.7	168.7	147.4	142.3	191	26
April	96.6	270.8	357.4	370.9	273.9	367	51
May	304.3	370.3	340.5	228.3	310.8	417	56
June	390.5	352.9	343.3	394.4	370.3	496	65
July	406.5	399.1	344.1		383.2	514	73
August	408.7	388.8	342.6		380.0	509	72
September	339.2	159.8	284.5		261.2	350	46
October	241.1	125.3	186.7		184.4	247	33
November	97.0	20.4	47.2		54.9	74	10
December	141.0	49.7	40.8	6 mos.	77.2	104	14
Total	2,717.3	2,491.4	2,532.8	1,259.2	2,585.4	3,467	40

Similar data were segregated for the power supplied from the Tulare station, which is used wholly for the irrigation of alfalfa. These show a much greater annual variation than the results for the use in the citrus districts. This is accounted for in part at least by the varying prices received during these years for alfalfa. Many farmers raising alfalfa for sale put on all the water which they could pump in 1912 and 1913. In 1914 and 1915, when the price of alfalfa fell, only sufficient water was used to keep the stand alive. The same general basis of deducting metered use and line loss was used for this circuit as for those from the Lindsay substation. The results are shown in Table 6.

The advantage to the company of the flat rate for agricultural power in the security of their returns from use is evident from this table. On a meter rate the

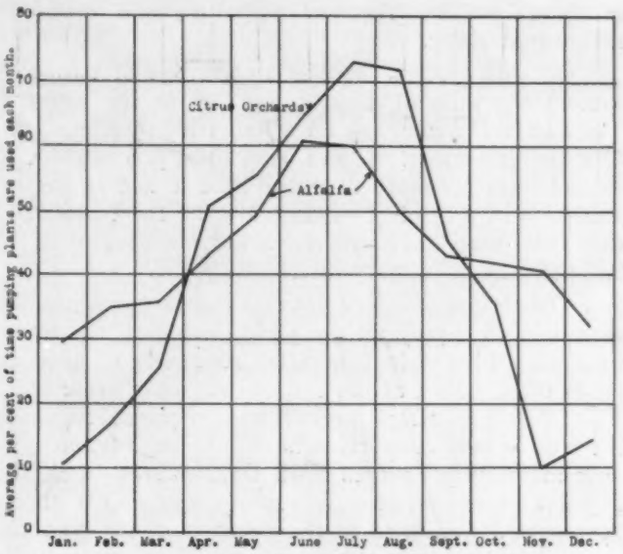


Fig. 2. Average Per Cent of Time Pumping Plants Are Used Each Month for Citrus Orchards and for Alfalfa.

Table 6—Use of Power by Motors on Flat Rate on Alfalfa.

	Kilowatt Hrs. Per Tested Horsepower.					Hrs. Op'n, O'pd	% Time
Month.	1912.	1913.	1914.	1915.	Av.	Av.	Av.
January	175.1	270.7	134.9	55.8	159.1	213	29
February	247.2	282.5	139.9	21.7	172.8	232	35
March	251.6	313.0	208.3	22.1	198.8	266	36
April	235.6	317.2	307.1	64.6	231.1	310	43
May	261.3	351.2	321.6	146.0	270.0	362	49
June	333.2	323.0	314.5	344.0	328.7	441	61
July	347.6	367.0	287.9		334.2	448	60
August	333.8	397.1	108.7		279.9	375	50
September	244.3	359.6	83.8		229.2	307	43
October	258.9	351.6	97.3		235.9	316	42
November	306.0	262.5	88.1		218.9	293	41
December	240.5	230.6	64.5		178.5	239	32
Total	3,235.1	3,826.0	2,156.6		2,837.1	3,802	44

Typical Pumping Plants.

earnings from the irrigation of alfalfa would have fluctuated materially.

On this system there is an average of two consumers per mile of distributing line in the country. The cost to the company for distributing lines has been $300 per consumer. It has been their practice not to extend lines for more than one mile to secure the installation of a 7½ h.p. motor. By the enforcement of this rule, they have secured a service density of 13 h.p. per mile of primary distributing line.

The former standard flat rate contract required the consumer to supply all the plant, including the transformers. Five-year contracts, renewed or dropped on 30 days' notice at the end of each year, were used. This longer contract period was required to cover the cost of long connection lines. As their territory is now more fully covered with transmission lines, the expense of connections is usually less and a three-year period was fixed in the decision of the commission. The flat rate was formerly based on annual tests made between May and August. Tests were made only during actual operation by the owner, no plants being started for testing alone. The flat rate charge was based on such tests unless they showed less than three-quarters of the rated capacity of the motor to be in use, in which case three-quarters of the rated capacity was taken as the minimum for motors of over 3 horsepower.

For motors of 3 horsepower or less, the minimum was based on the actual rated horsepower. A meter rate contract with a minimum yearly charge on all size motors of $24 per horsepower of installed capacity was also in use. This form of rate is of advantage in young orchards where the plant is only partially used.

The rate schedule fixed by the Railroad Commission reduce the contract flat rate for 12 months' service to $42.30 per horsepower. Flat rates for any number of months' use were also fixed, that for seven months' service being $29.75 per horsepower. These rates are based upon connected load in motors. Under normal conditions meters will not be installed by the company on strictly flat rate business, but at the consumers' request demand-indicating and watt-hour meters will be supplied at a charge of $7.50 per year, and the flat rate charges per horsepower of connected load will be readjusted on the basis of 94 per cent demand factor.

A non-contract flat rate of $7 per horsepower for the first month and decreasing to $2.30 per horsepower for the twelfth month's service is also provided. The total for 12 months under this rate is also $42.30 per horsepower, but the consumer is required to pay for the cost of the initial service connection and subsequent disconnections made at his request.

Meter rates on both contract and non-contract basis are also provided. On the contract basis, the demand charge is $22.05 per horsepower for twelve months' service, plus $.005 per kilowatt hour. A similar non-contract rate for metered service to that for non-contract service is provided, the demand charge varying from $4.50 per horsepower for the first month to $1 per horsepower for the twelfth month, the total for twelve months being $22.05 per horsepower. The energy charge is also $.005 per kilowatt hour, the consumer paying the cost of connection.

PROSPECTIVE POWER MARKET FOR IRRIGATION PUMPING IN OREGON AND WASHINGTON.

BY JOSEPH JACOBS.

(Continued.)

General Features of all Projects.

The present scope of this report will not permit discussion in detail of all the projects which came under my examination, and I shall therefore review, under the general caption above, those features which are common to all, and to a certain extent identical for all the projects. Unnecessary repetition in considering the individual projects will thus be avoided.

Accompanying maps.—Illustrating the text of this report is a general map of the Pacific Northwest, which was previously referred to in the general report, showing the locations and areas of possible irrigation pumping projects, and a tabulation herewith showing all important data relating to these irrigation pumping projects such as areas, rainfall, water duty, unit costs, power requirements, etc.

Transportation facilities.—Reference to the map will indicate what these facilities are, but in general it may be said that the projects herein considered lie immediately along the Columbia River and Snake River Valleys, and that this region is served by the Spokane, Portland and Seattle Railway, the Oregon-Washington Railroad and Navigation Company, the Northern Pacific Railway, the Chicago, Milwaukee & St. Paul Railway, and by navigation on the Columbia River. At least two, and in most instances three of these lines of transportation service are available to all the projects as will be readily noted on the map.

Soil.—More or less important differences in soil conditions were noted on the different projects. These differences relate chiefly to the relative proportions of sand and loam contained in the soil, to the character of sub-soil and to the fineness of soil texture. In general, however, the soil of most of the projects may be described as a sandy volcanic loam, usually not much in excess of three feet in depth and usually underlain with strata of sands and gravels. These varying conditions, particularly that of fineness of texture, have an important bearing upon the moisture retentive capacity of the soil and they were given special consideration in fixing upon the duty of water.

Climate.—The climatic conditions are such as to make successful agriculture absolutely dependent upon irrigation. An average annual precipitation of about 9 in. and long hot summers with mid-day temperatures frequently above 100 deg. F., are the dominant climatic characteristics of the major part of the area under consideration.

Crops.—From the extensive experience already had in irrigated agriculture along the Columbia River Valley, it is known that all the deciduous fruits such as apples, pears, peaches, plums, etc., do well in these soils and this climate and that grapes, berries, vegetables and all the forage crops, particularly alfalfa, are successfully and profitably grown. Despite the fact that soil and climate conditions are well adapted to fruit culture and certain localities particularly so, experience has shown that mixed farming is the more dependable over long periods of time and therefore on each project it was assumed that forage crops would constitute a considerable portion of the culture. The

relative proportions of land which it was assumed would be devoted to forage crops and to fruit and vegetable crops are as shown in Fig. 40, these constituting an important element in the determination of water duty.

Irrigation season.—As shown in Fig. 40, the irrigation season for different projects has been taken at from six to seven months, the earliest date being March 15th and the latest date October 15th, except for the district between Grand Dalles and Vancouver, where, on account of the great annual precipitation, the irrigation season was made approximately shorter.

Water duty.—The elements which controlled and the assumptions made in determining water duty for the several projects were as follows:

1. Character of the soil and its underbody.
2. Annual precipitation and precipitation during the irrigation season.
3. Relative proportion of forage and fruit crops adopted for the project.
4. That all main canals, as well as the canals of the distribution system down to capacities of 10 s.f. and 5 s.f. would be concrete lined, flumed or piped in order that seepage losses might be reduced to a minimum.
5. That wasteful usage of water would be prevented by the adoption of a rotative system of delivery and by the enforcement of rigid regulations in relation thereto on the part of project managers.

The adoption of such regulations and their rigid enforcement will go far toward improving water duty and toward rendering feasible projects that otherwise could not be considered.

The water duties adopted for the different projects are as shown in Fig. 40.

Land values.—Prices at which raw lands are now held vary largely according to their accessibility to and their altitude above available pumpage water supplies. The higher bench lands are held at figures that range generally from $10 to $25 per acre, while the low lands along the river bottom are held at figures which range generally from $25 to $75 per acre. This feature of raw land values is one of much importance to any program of irrigation development by pumpage for it is one of the main determining factors of permissible lift upon which depends the area which may be reclaimed and the amount of power that will be required. The successful development, under public auspices, of some of the larger projects, and in order that unrestricted speculative values may not render the projects infeasible, may require that the public again secure the lands, where these are largely in private ownership, or that the pledging of these lands at a reasonable selling price be made a condition precedent to construction of the project.

Storage.—A few of the projects examined seem to offer some possibilities of storage. To the extent that good storage could be developed there would be created a demand for winter power that otherwise might not be utilized and its tendency would be to slightly reduce the annual cost of power to the project. It would also provide a certain margin of safety against a possible break-down of the pumping plant during the irrigation season. In addition to its cost, an adverse effect of such storage would be to reduce the irrigable area of the project, because these reservoir sites all embrace good irrigable lands which form part of the general body of land of the project. It should be stated further that the feasibility of these reservoir sites have not been proven and it is quite possible that their careful examination, by means of borings, would prove them to be infeasible. The reservoirs also would be fed, not by gravity supply, but by pumpage from the same source that the irrigable lands would be directly served and there would therefore be no reduction in total power consumption per year if indeed there were not a slight increase. In view of these conditions I have ignored the matter of storage in developing present cost estimates for the projects, and attention is called to it here merely as a possibility which, in some instances, might render the project somewhat more feasible.

Estimated costs.—The estimated costs, as shown in Fig. 40, include not only the pumping plants, including stepdown transformers, but also all other features of the irrigation project. These estimates, in the absence of actual surveys, are necessarily rough approximations but they constitute the best basis now

Tabulation of Data relating to Irrigation Pumping Projects

Name of Project	State	Source of Water Supply	Area in Acres Gross	Irrigable	Crops Forage	Fruit & Vegetables	Mean Annual Precipitation	Irrigation Season From	To	Water Duty Delivery	Pumpage	Average Pumpage Head Max.	Mean	Approx. Motor Capacity H.P.	Transmission Distance Miles	Approx. Cost of Complete Project per Acre	Annual Cost of Maintenance & Operation per Acre A	B	Cost of Power per H.P. per Year	Cost of Power per Acre Foot	Power Constant from 1 of Motors in K.W. per Inr. Second	Installation Improvement of Gen. Sta. K.W.
Grand Dalles	Washington	Columbia River	3000	2000	40%	60%	16.0	Apr. 15	Oct. 15	21"	26.25	520	373	16.1	1200	3	$ 77.	$ 8.75	$16.00	$ 8.80	0.345	2 825 000	
Roosevelt Flat	"	"	1100	1000	60	40	10.0	"	"	24	26.70	245	245	8.	400	45	60.	5.35	11.95	9.42	0.398	945 000	
Horse Heaven Slope	"	"	7630	6100	50	50	9.6	Mch. 15	"	31	38.75	394	300	593	3540	95	61.	6.64	13.43	9.90	0.306	108 000 000	
Berrian Slope	"	"	6100	4300	50	50	9.3	"	"	30.	37.50	494	367	41.	2800	95	63.	7.70	14.50	9.80	0.324	8 550 000	
Three Rivers Slope	"	Snake River	49500	42000	50	50	8.0	"	"	33.	41.25	487	343	435	28500	141	58.	8.63	14.98	10.85	0.360	8 575 000	
Pasco	"	Columbia River	100 000	80000	60	40	7.5	"	"	33	41.25	355	265	833	41700	126	50.	6.59	12.32	10.38	0.341	12 650 000	
Benton	"	"	146000	109000	60	40	8.0	Apr. 1	"	40.	50.	362	225	1438	61200	157	48.	7.30	12.60	10.83	0.375	17 700 000	
Priest Rapids	"	"	128000	112000	60	40	7.0	"	"	37.	46.25	420	316	1369	82000	170	49.	9.38	14.02	11.49	0.379	24 000 000	
Beverly	"	"	5000	4000	50	50	7.5	Apr. 15	"	36.	45.	150	100	53.	1000	173				11.62	0.448	2 600 000	
Between Miller & Arlington	Oregon	"		1000	50	50	12.5	"	"	24.	26.70	100	60	7.8	100	12.445				9.50	0.401	260 000	
Arlington Gulch	"	"	900	600	50	50	9.4	Apr. 1	"	27.	32.	340	281	53.	300	49	75	6.74	16.49	9.75	0.325	780 000	
Willows Slope	"	"	5200	1600	60	40	9.1	"	"	28	33	403	353	14.	1000	55	91	7.60	18.59	9.82	0.364	2 700 000	
Castle Rock Slope	"	"	172000	150000	60	40	8.6	Mch. 15	"	38	48.50	457	381	1820	13070	91	65	10.10	17.21	10.00	0.330	400 000 000	
" " (Alternative)		"	62000	50000	60	40	8.6	"	"	38.	48.50	310	310	608	35700	91	52	8.46	14.46	10.00	0.332	108 300 000	
Between Grand Dalles & Vancouver	Ore. & Wn.	"		10000	20	80	26.0	May 15	Oct. 1.	15.	18.	600	250	77.	3600	5475				9.50	0.490	7 000 000	
Blalock Island	" "	Col. River & Wells	4500	2400	40	60	9.1	Mch. 15	Oct. 15	32.	40	50	40	24.	285	77	45	2.78	7.72	10.19	0.364	835 000	
Wallinger Island and other islands near Pasco	" "	" "		1500	40	60	9.0	"	"	30.	37.50	50	40	14.	165	105				14.00	0.475	488 000	
Existing Projects: Attalia Land Co.	Washington	Columbia River		3500	50	50	7.1	"	"	32.	40.	60	50	35.	330	149				12.46	0.412	1 000 000	
Burbank Co.	"	Snake River		1400	50	50	6.7	"	"	32.	40.	85	75	140.	3000	126				10.51	0.345	6 100 000	
Pasco Mec'l. Co.	"	"		1300	50	50	6.3	"	"	30.	36.	120	110	117.	2400	126				10.80	0.352	7 400 000	
Hanford	"	Columbia River		1500	60	40	7.0	Apr. 1	"	40.	50.	68	58	198	2240	161				13.24	0.428	6 300 000	
Hanan Irr. Co.	"	"		600	60	40	7.0	"	"	36.	45.	85	75	71.	1000	158				11.70	0.402	2 915 000	
Beverly Land Co.	"	"		1200	50	50	7.1	Apr. 15	"	36.	43.84	85	75	15.8	220	173				11.62	0.454	565 000	
Total exclusive of Castle Rock Slope Alternative				63500											39600							188 513 000	2 500 000

Fig. 40.

available for judging the feasibility of the project, so far as such feasibility may be indicated by cost. Where so many projects are being considered and under the conditions indicated it should not be expected that future detailed investigation of any individual project will exactly confirm the figures herein given. These figures, however, are believed to be large rather than small, and viewed as a whole in respect to their bearing upon the Celilo development they may safely be accepted as conservative.

Annual charges.—It will be noted in Fig. 40 that the annual cost of maintenance and operation is given under two conditions for each project. The first covers only the cost of power, attendance at pumping station and the ordinary repairs and up-keep of the pumping plant and the general irrigating system. It excludes the items of depreciation, interest and taxes upon the assumption that the former will be met by special assessments when required, and the latter two items will be charged against the land and not against the irrigation project, it being not unusual to include the actual cost of irrigation works in the value of the land for general taxation purposes.

The cost under the second condition includes all of the above, also interest at 6 per cent and taxes at 1 per cent on the total investment and depreciation varying from 4 to 6 per cent, depending upon the character of the works employed. The first condition, therefore, represents the minimum charge that would need be made each year against the landowner to meet the immediate cash outlay for maintenance and operation, while the second represents the total cost of such maintenance and operation if the irrigation works be considered as an entity apart from the land.

(To be continued.)

The electric output of the various power plants of the United States Reclamation Service operated in 1914 was over 66,000,000 kw.-hrs. The total capacity of the 12 plants in operation was 27,134, kw., and the first cost of the plants $2,542,000. Of the total output, 39 per cent was sold to customers, 32 per cent was used for irrigation pumping, 17 per cent for construction purposes, 4 per cent for drainage, the remaining 8 per cent represented losses. It was estimated that the power remaining undeveloped on all the different projects amounted to a total of 489,000 h.p. Of this 360,000 h.p. consisted of the estimated capacity on the Flathead River in Montana, the remainder being distributed through 21 other power sites.

Direct telephone connections with all parts of irrigation systems is coming to be recognized as a necessity. This is essential both for routine distribution of water on large systems and also for emergency use at time of accidents to the canal. On the projects of the United States Reclamation Service over 2500 miles of telephone line are in use. The average cost of this, including telephones, has been $160 per mile. On the different projects the acres served per mile of telephone varies from 300 to 1500, being smallest on those systems having long diversion canals, and largest for the more compact projects. The average for the operating projects is one mile of telephone line to about 700 acres.

OIL WELL MOTOR EQUIPMENTS.

BY W. G. TAYLOR.

(These data on horsepower requirements and kilowatt-hour consumption for drilling, pumping and cleaning California oil wells are taken from a paper presented at the thirty-third annual convention of the American Institute of Electrical Engineers, Cleveland, Ohio, June 27-30, 1916. The author is engineer with the power and mining department of the General Electric Co. at Schenectady.—The Editor.)

Oil well motors are called upon to perform three groups of duties,—drilling, pumping and cleaning. The most logical method of applying motors to these operations is to use a different machine for each of the three groups, as this not only involves the least complication in design, but also requires the minimum investment by the oil company, consistent with efficient operation. It has, however, been found more practical in most cases to use one motor for the drilling process and another for all the work involved in pumping, pulling and cleaning the wells.

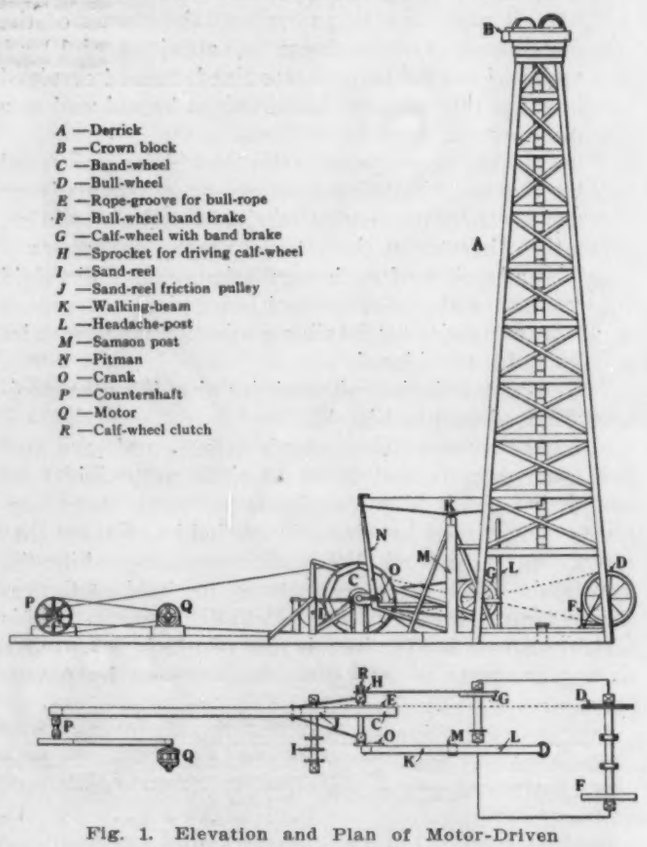


Fig. 1. Elevation and Plan of Motor-Driven Standard California Oil Well Pump.

Drilling.

The arrangement of the standard motor-operated drilling rig used in the California field is illustrated in Fig. 1. The heaviest work is "spudding in" the case which requires continued reversing of the motor under heavy load. The motor should have ample margin in torque to accomplish this without overheating or stalling, as failure to free the string of casing compels the operator to continue with a smaller diameter.

Less power is required to swing the tools during actual drilling, this demand decreasing as the well deepens, because the deeper drilling tools are smaller and a large amount of water is usually carried in the

hole. On the other hand more time and power are required for bailing deeper wells so that the kw.-hr. consumption increases approximately as the square of the depth, barring accidents and extensive "fishing" for lost rope, tools or damaged casing. The average is about 234 kw.-hr., varying between 135 and 400 kw.-hr., depending upon the class of work,

The most successful drilling motors now used in American oil fields are of the slipring induction type with secondary resistance control arranged for reversing duty. A capacity of 50 h.p. is usually sufficient for wells not exceeding 2500 ft. in depth, though cases have occurred where 75 h.p. was necessary on wells

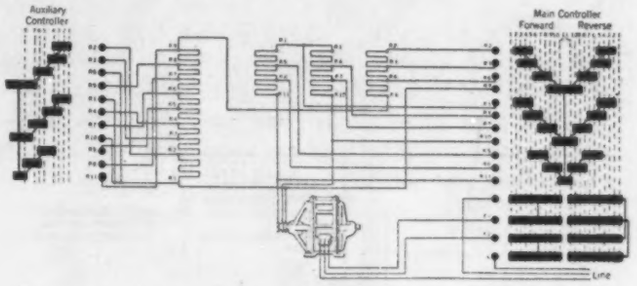


Fig. 2. Connections for Motor Equipment for Standard Cable-Tool Drilling.

from 2000 to 2500 ft. in depth, as well as on the deeper ones. The belted arrangement with a countershaft has proved the best, as the severe service has rapidly put out of commission the various types of gear drive which have been tried.

In the cable-tool method of drilling, the beam must overspeed and allow a relatively free drop of the tools on the down stroke to obtain the most effective blow; the motor to accomplish this must therefore slow down on the up stroke and speed up on the down stroke. This is quite successfully accomplished by so proportioning the pulleys that the motor will have some secondary resistance in circuit when running at the correct drilling speed. There is also required a very fine adjustment of speed to make the movement of the beam accord with the natural period of vibration of the drilling line due to its elasticity. Failure to obtain the exact speed results in deadening the movement of the bit and may strain the line and rig dangerously. A suitably designed liquid rheostat would be an ideal method of control if it received the necessary attention and a good quality of water, but unfortunately neither of these can be given until the usual conditions in the oil fields and so drum controllers have been adopted, connected as shown in Fig. 2. The main controller gives a coarse variation of speed and reverses the motor, and the auxiliary controller provides a means of obtaining fine speed control between the points on the main controller for either direction of rotation. These controllers are each operated by wire ropes extending to the headache-post in the derrick, the arrangement in this respect being similar to the method of throttle control employed with engine-driven rigs.

Pumping, Pulling and Cleaning.

Pumping is accomplished by means of a deep-well pump of the plunger type which is lowered on the end of a string of tubing to a sufficient depth to insure ample submersion. The plunger is operated by jointed iron or wooden rods extending down within the tubing and attached to the end of the walking-beam or to a pumping-jack operated from a central power-head. The flow of oil through the tubing to the surface is governed by suitable check valves in the barrel and plunger of the pump.

The rods and tubing must be frequently removed to clean out the well or to replace broken or worn parts, and the bull-wheel is then employed except where the use of pumping-jacks makes a portable hoist necessary. Rods are pulled with a single line, but a block and tackle with two or three lines is necessary for the tubing. Both are removed in lengths approxmately 60 ft. long which usually consist of three 20 ft. sections screwed together. Bailing, light redrilling, washing or swabbing may be employed in the process of cleaning.

There is no apparent way to calculate the power necessary to pump a well which will give figures uniformly consistent with actual tests, because of the difficulty of determining the effect of varying well conditions. For instance, a large amount of sand in the oil will increase the power necessary to pump it, while on the other hand gas may be present which will help lift the oil. The following summary of records from over 200 California oil wells pumped on the beam, gives an idea of the motor load for pumping alone:

Depth of wells	900 to 3100 ft., ave. 1430 ft.
Length of stroke	29 to 32 in.
Strokes per min	20 to 30, ave. 24.
Diameter of tubing	3 in.
Power required	1 to 5 h.p., ave. 3.5 to 4 h.p.

Where changes are frequently taking place in well conditions such as the rate of oil flow, the amount of sand with it, the amount of gas or water in the oil, the viscosity of the fluid or the condition of the pump itself, it is necessary to have a variable speed motor to permit the operator to pump at what he considers is the maximum economical rate, which may be limited by the rate of oil flow or the rapidity with which the rods and plunger will drop in the oil on the down stroke. On the other hand there are many cases where squirrel-cage motors meet all the requirements of pumping.

Pulling the rods and tubing is ordinary hoisting work, carried on at a maximum speed of the band-wheel which may be from 50 per cent to 100 per cent higher than the pumping speed. It demands an intermittent motor output of from 35 to 80 h.p. or even higher under some circumstances. A high torque machine is therefore most suitable. The greatest heating of the motor occurs when handling rods, because of the frequent reversals which may occur from three to five times a minute for an hour and a half to two hours at a time. Low armature inertia is consequently desirable. Pulling tubing requires the highest torque and determines the size of motor necessary. The rating usually given the meter for this duty is merely nominal, as the maximum torque obtainable is the determining feature. The maximum load is that encountered when lifting together the rods and pump and the tubing full of oil. In determining the motor capacity it is convenient to use the following formula for the horsepower required to lift tubing at a uniform rate of speed:

$$\text{h. p.} = \frac{W \times d \times N}{63{,}000 \times L}$$

in which **W** = weight lifted in lbs.

d = diameter of bull-wheel shaft in inches.

N = rev. per min. of bull-wheel

L = number of lines used in the tackle.

The constant 63,000 is based on a mechanical efficiency of the rig of 50 per cent, which is a fair assumption for the majority of cases. In addition to the value obtained from this formula there must remain a sufficient margin in torque for acceleration. This depends largely upon the flywheel effect of the motor armature, as the revolving parts of the rig have relatively small inertia.

Of the various operations of cleaning a well, swabbing requires the heaviest demand of power. The work consists of lowering a plunger into the well casing and then pulling it out. The plunger has a tight fit in the casing so that the suction thus produced draws the sand out of the perforations at the bottom and thus clears the oil passages. The operation may be performed for several hours at the rate of two to four times per hour, each hoisting trip of the swab requiring several minutes. Peak inputs to the motor from 40 to nearly 70 kw. have been recorded in this work.

The total monthly power consumption for all the work of pumping, pulling and cleaning a well will vary from approximately 1350 to 6000 kw.-hr. but the average is about 2100 kw.-hr.

The necessity of employing a single motor for all of the work of pumping, pulling and cleaning is due chiefly to the impracticability of using a portable hoisting equipment for wells that may have to be pulled every few days, particularly where the country is rough; and the desire of most operators to have a machine which will take the place of the steam engine with little or no change in the method of operation.

The most successful and most widely used induction motors for this duty are of two types, the "Y-delta" and the two-speed. Except in special instances both are of the slip-ring type, the former being designed for changing the normal capacity by a change in stator connections made by a suitable switch, this not, however, affecting the speed; the latter has a pole-changing switch mounted on the frame by means of which both the speed and capacity are changed. Both machines require a controller and secondary resistance for speed variation, which with the two-speed motor are effective on either the high or the low speed connection, as a six-phase rotor winding is used. A synchronous speed of 900 or 1200 r. p. m. is usually selected for either type of motor, and a half-speed connection is used on the two-speed machine. Various ratings are employed, depending upon what the conditions require, among which are 20/7 h.p., 20/10 h.p., 25/8 h.p. and 30/15 h.p. Smaller motors than these generally cannot develop the overload torque occasionally necessary in emergencies on nearly all wells. The low capacity is used for little else but pumping, and the design is therefore made for as high an efficiency as possible on this connection without sacrificing the required torque on the higher rating. The maximum momentary capacity is from 300 per cent to 450 per cent of the high rating, but full-load efficiencies of from 75 per cent to 85 per cent, and power factors nearly as good, are nevertheless obtained at full load on pumping duty.

With the Y-delta motor, a high speed for pulling can be obtained only by changing the pulley or by lagging up the bull-wheel shaft to a large diameter. Few operators care to be bothered with the pulleys, while there are some who will not consider the other method because of the increased strain on parts of the rig. Lagging the bull-wheel shaft furthermore does not speed up the sand-reel, so bailing must be done very slowly. But where the operator will use a lagged shaft and has no sand-reel, the Y-delta motor does very well, except for one point which in many cases is important. It is very often the practice to "shake-up" a well to free the pump valves from sand and thus avoid pulling the rods and tubing. This is accomplished by increasing the speed of the walking-beam for a few minutes, but there is no practical way to do so with this type of motor, as the time required to change pulleys makes this method out of the question. The two-speed slip-ring motor, as may readily be seen, overcomes all these difficulties and has therefore received wide-spread approval by practical oil men.

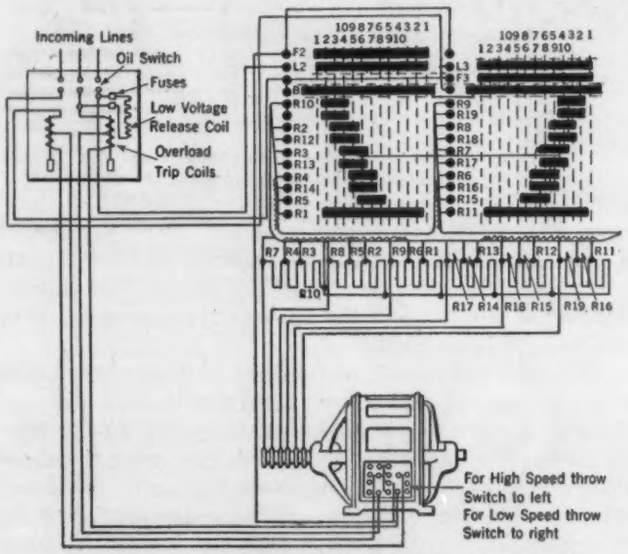


Fig. 3. Connections for Two-Speed Motor Equipment for Pumping, Pulling and Cleaning Duty.

The connections of the two-speed equipment in Fig. 3 shows the method of protecting the double-rated motors by double-bound overload trip coils on the oil switch, which are so interlocked by connections with the switch on the motor that proper protection is automatically obtained. The controller is operated by a rope wheel from the derrick as described for the drilling motor.

While the majority of installations use a belted motor with countershaft, there are many back-geared machines in operation. Oil men display a preference for the former, but as most of the gear noise has been recently eliminated by the use of cloth pinions, it is anticipated that more of these will be used in the future.

THE OREGON WATER CODE AND THE SUPREME COURT OF THE UNITED STATES.

BY A. E. CHANDLER.

(This cogent analysis of the present status of the determination or adjudication of water rights in Western states is inspired by recent decision of the U. S. Supreme Court upholding the Oregon Water Code. The author is a member of the California Water Commission and a recognized authority on water law.—The Editor.)

As previously stated in these columns, the three essentials of an effective "water code" are: first, the control of new appropriations; second, the determination or adjudication of existing rights; and third, the distribution of water among those entitled to its use. The last of the three is the real goal to be sought, the other two being but means to that end. Students of water right legislation have been in accord for many years regarding the best method of securing the first and third essential (in order of enumeration), but there has been a decided disagreement as to the best method of making a determination or adjudication.

The first of the western states to provide a special statutory procedure for settling water right conflicts was Colorado. By its acts of 1879 and 1881 the entire state was divided into districts and a procedure adopted for the adjudication of all of the rights to the use of the waters of a stream within a district in a single action in the district court—special provision being made for the taking of testimony before referees. The weakness of the Colorado method was (and is) the fact that the state was not represented in the adjudications and most of the earlier decrees were excessive, that is, not only were the amounts of water decreed not based upon beneficial use but very often a ditch was given an amount equivalent to many times its capacity.

Wyoming in 1890-1891 sought to improve upon the Colorado method by providing a board of control, composed of the state engineer and four division superintendents, and giving to it the authority to make determinations of existing rights. Actual surveys of ditches and irrigated land are made by the state engineer and the evidence regarding priority presented by the claimant on a simple form called "proof of appropriation." After the survey is completed for an entire stream and all of the proofs assembled, the latter, at a time and place duly advertised, are thrown open to public inspection. If a claimant desires to contest the claims of another, a hearing before the division superintendent is held after notice properly given. At such hearings stenographic reports are made of the testimony submitted. The board of control, with the surveys, proofs and testimony before it, makes a determination of the priority and amount of each appropriation and issues certificates in accordance therewith. Such determination is final unless an appeal is taken to the courts.

The Wyoming method is well called "the administrative method." It has worked admirably and comparatively few cases have been appealed to the courts. So novel an institution could not be expected to stand long without an attack being made upon its validity, but the Supreme Court of Wyoming, in Farm Investment Co. v. Carpenter (61 Pac. 258), in very positive language upheld the act on every point presented. The method was adopted in Nebraska in 1895. It has worked effectively there and has been upheld repeatedly by the Supreme Court of Nebraska. Nevada followed the lead of Wyoming and Nebraska in 1903.

The congressional Reclamation Act was passed in 1902. On account of the millions thus made available for expenditure in irrigation works, it offered a material incentive to the western states to clarify the water right situations so that the Reclamation Service would the more speedily approve projects. Although the Wyoming method of water right determination had worked so well in both Wyoming and Nebraska, other states hesitated to accept it on the grounds that it was administrative and not judicial. They accordingly passed legislation providing for surveys and assembling of hydrographic data by the state engineer but also providing for a regular suit to be brought against all claimants by a representative of the state. Such legislation was adopted in Idaho and Utah in 1903, in North Dakota, Oklahoma and South Dakota in 1905 and in New Mexico in 1907. As stated above, the "administrative method" was upheld by the Supreme Courts of Wyoming and Nebraska. The "judicial method" has, however, been declared invalid by the Supreme Courts of Idaho and South Dakota, and has produced practically no results in the other four states above mentioned.

Irrigation had created so little stir in Oregon prior to the passage of the Reclamation Act (June 17, 1902), that practically no stream measurements had been made on Oregon streams by the United States Geological Survey. After the passage of the Reclamation Act, the state became very active along irrigation lines and took immediate steps towards introducing a modern water code. In 1905, the office of state engineer was created, but little other effective water legislation was enacted. In 1907 an attempt to pass a bill, similar to the Idaho and South Dakota acts, failed, but in 1909 the present "water code" was adopted. The code follows the Wyoming act very closely—in fact, whole sections are actual copies. The distinctive feature of the Oregon code is the last step in the method of adjudication. It is exactly the same as the Wyoming method up to the determination of existing rights by the board of control (now called the "water board" and composed of the state engineer and the two division superintendents). Instead of allowing the board's determination to stand until appealed, the Oregon statute provides that it shall be passed to the circuit court, with the surveys, proofs and evidence upon which it is based, to be affirmed or modified after consideration by the court in a comparatively simple proceeding.

The Oregon code has been before the Supreme Court of Oregon a number of times and its provisions have been upheld. It was recently considered by the United States Supreme Court in the case of Pacific Live Stock Co. v. Lewis, decided June 5, 1916. As has been stated above, the Wyoming or "administrative" method of water right determination is the one which has produced satisfactory results. The states following the "judicial method" have recognized the results but have doubted the validity of such procedure. Idaho and Utah now have commissions at work preparing recommendations for new legislation

They will be joined by those interested in California and Washington in welcoming the decision in the Pacific Live Stock Co. case, as the United States Supreme Court therein upholds the Oregon code. As above stated, Nevada introduced the Wyoming method of determining water rights in 1903. A decision of the Supreme Court of Nevada in 1914 indicated that such determinations could not be considered conclusive. In 1915 the Nevada act was amended so that the system there is now identical with the system in Oregon.

The recent decision of the United States Supreme Court is, therefore, of so far reaching importance that the following extracts (comprising about 70 per cent of the complete opinion) are printed instead of a brief abstract. It is certain that the clear language of Mr. Justice Van Devanter will commend itself to all interested in the development of our water resources:

PACIFIC LIVE STOCK CO., Appellant, vs. JOHN H. LEWIS, JAMES T. CHINNOCK, and GEORGE T. COCHRAN—constituting the State Water Board of the State of Oregon, et al. } Appeal from the District Court of the United States for the District of Oregon.

(June 5, 1916.)

Mr. Justice Van Devanter delivered the opinion of the court.

This is a bill in equity to enjoin a proceeding before the State Water Board of Oregon looking to the ascertainment and adjudication of the relative rights of the various claimants to the waters of Silvies River in that state, the grounds upon which such relief is sought being (a) that it is essential to protect a jurisdiction previously acquired by the District Court, and (b) that the local statute, 3 Lord's Oregon Laws, Title XLIII, Chap. 6; Laws 1913, Chaps. 82, 86 and 97, authorizing and controlling the proceeding, is repugnant to the due process of law clause of the Fourteenth Amendment. * * * * * A general outline of the statute, as it has been construed by the Supreme Court of the state, will serve to simplify the questions to be considered. It recognizes that in Oregon rights to use the waters of streams for irrigation and other beneficial purposes may be acquired by appropriation, adopts a comprehensive scheme for securing an economical, orderly and equitable distribution of the waters among those entitled to their use, incidentally prescribes a mode of determining the relative rights of the various claimants to the waters of each stream, and in large measure commits the administration of the scheme to the State Water Board and officers acting under the supervision of its members. When one or more users of water from any stream request it, the board, if finding that the conditions justify it, is required to set in motion a proceeding looking to an ascertainment and adjudication of all rights to the waters of that stream. Every material step in the proceeding is to be attended with notice and an opportunity to be heard, the adequacy of which is manifest. * * * The board is then to examine all the evidence, make findings of fact therefrom, enter an order embodying the findings and provisionally determining the relative rights of the several claimants, and transmit the evidence and a copy of the order to the circuit court of the county wherein the stream or some part of it lies. Exceptions to the board's findings and order may be presented to the court and in disposing of them the court is to follow as near as may be the practice prevailing in suits in equity. All parties in interest, including the board as representing the state, are to be fully heard.

Further evidence may be taken by the court, or the matter may be remanded with directions that additional evidence be taken and that the matter be again considered by the board, in which event the evidence and a copy of the further order of the board are to be transmitted to the court as in the first instance. In short, upon exceptions the court may re-examine the whole matter and enter such decree as the law and the evidence may require, whether it be an affirmance or a modification of the board's order. And even where no exceptions are presented a decree giving effect to the order is to be entered, that is to say, the matter is not to be left as if the order in itself constituted an effective adjudication. * * *

* * * At the time the statute was adopted, and continuously until this suit was begun, there were pending undetermined in the District Court two suits in equity brought by the present plaintiff, one against two Oregon corporations and the other against another corporation of that state, in each of which suits the relative rights of the parties thereto in the waters of Silvies River were in controversy. These rights are reasserted and again brought in controversy in the proceeding before the board.

When that proceeding was first set in motion, the Pacific Live Stock Company, the plaintiff in this suit, presented to the board a petition and bond for the removal of the proceeding, or a part of it alleged to involve a separable controversy, to the District Court of the United States upon the ground that it was a suit between citizens of different states. But the attempted removal was not sustained, for the District Court remanded the proceeding and in that connection held that while it was pending before the board it was essentially preliminary and administrative, and not a suit at law or in equity within the meaning of the removal statute, 199 Fed. 495.

Thereafter the plaintiff presented to the division superintendent a sworn statement of its claim, accompanied by the fee prescribed—at the same time protesting that the fee was extortionate, that the matter should be adjudicated in the Federal Court, and that the local statute was repugnant to the Foureenth Amendment. More than two hundred other claimants also appeared and submitted statements of their claims, all being described as higher up the stream than that of the plaintiff. When the statements were opened to public inspection many contests were initiated. Several of these were against the plaintiff's claim; a large number were by the plaintiff against other claims, and there were others in which, it is said the plaintiff was not directly concerned. It was a this stage of the proceeding, and before any evidence was taken in any of the contests, that this suit was brought.

Upon the assumption (1) that the removal proceedings were effective, (2) that the proceeding before the board is substantially identical with the pending suits, and (3) that the proceeding is essentially judicial in its nature, the plaintiff insists that the continued prosecution of the proceeding before the board constitutes an inadmissible interference with the District Court's jurisdiction and that this jurisdiction should be maintained and protected by an appropriate injunction. The insistance must be overruled, because the assumption upon which it rests cannot be indulged. * * * * * * The proceeding sought to be enjoined, although in some respects resembling the prior suits, is essentially different from them. They are merely private suits brought to restrain alleged encroachments upon the plaintiff's water right, and, while requiring an ascertainment of the rights of the parties in the water of the river, as between themselves, it is certain that they do not require any other or further determination respecting those waters. Unlike them, the proceeding in question is a quasi public proceeding, set in motion by a public agency of the state. All claimants are

required to appear and prove their claims; no one can refuse without forfeiting his claim, and all have the same relation to the proceeding. It is intended to be universal and to result in a complete ascertainment of all existing rights, to the end, first, that the waters may be distributed, under public supervision, among the lawful claimants according to their respective rights without needless waste or controversy; second, that the rights of all may be evidenced by appropriate certificates and public records, always readily accessible, and may not be dependent upon the testimony of witnesses with its recognized infirmities and uncertainties, and, third, that the amount of surplus or unclaimed water, if any, may be ascertained and rendered available to intending appropriators. * * *

* * * In such a proceeding the rights of the several claimants are so closely related that the presence of all is essential to the accomplishment of its purpose, and it hardly needs statement that these cannot be attained by mere private suits in which only a few of the claimants are present, for only their rights as between themselves could be determined. As against other claimants and the public the determination would amount to nothing. And so, upon applying the test before indicated, it is apparent that the assumed substantial identity between the proceeding and the pending suits does not exist.

* * * As an alternative to its first contention, which we hold untenable, the plaintiff insists that the statute is repugnant to the due process of law clause of the Fourteenth Amendment, first, because it requires a claimant, at his own expense, to assert and prove his claim before the board, and to pay an extortionate fee for having it considered,—all under penalty of forfeiting his claim if he refuses,—notwithstanding the board acts only administratively and its findings and order are not conclusive; second, because it permits the board to accept and act upon the sworn statements of claimants taken ex parte and upon the data set forth in the unsworn report of the engineer, without, as is asserted, affording any opportunity for showing their true value, or the want of it, by cross examination or otherwise; and, third, because it requires that the board's findings and order, although only administrative in character, be followed and given effect in the distribution of the water pending the action of the circuit court upon them.

A serious fault in this contention is that it does not recognize the true relation of the proceeding before the board to that before the court. They are not independent or unrelated, but parts of a single statutory proceeding, the earlier stages of which are before the board and the later stages before the court. In notifying claimants, taking statements of claims, receiving evidence and making an advisory report the board merely paves the way for an adjudication by the court of all the rights involved. As the Supreme Court of the state has said, the board's duties are much like those of a referee. (And see Oregon R. R. & N. Co. v. Fairchild, 224 U. S. 510, 526-527.) All the evidence laid before it goes before the court, where it is to be accorded its proper weight and value. That the state, consistently with due process of law, may thus commit the preliminary proceedings to the board and the final hearing and adjudication to the court is not debatable. And so, the fact that the board acts administratively and that its report is not conclusive does not prevent a claimant from receiving the full benefit of submitting his claim and supporting proof to the board. That he is to do this at his own expense affords no ground for objection; on the contrary, it is in accord with the practice in all administrative and judicial proceedings. The fee alleged to be extortionate is a charge graduated according to the amount of land irrigated under the claim submitted, and is fifteen cents per acre for the first hundred acres, five cents per acre for the next nine hundred acres, and one cent per acre for any excess over one thousand acres. * * * In our opinion, the charge is not extortionate and its exaction is not otherwise inconsistent with due process of law.

Upon examining the statute and the decisions of the Supreme Court of the state construing and applying it we are persuaded that it is not intended that the board shall accept and act upon anything as evidence that is devoid of evidential value or in respect of which the claimants concerned are not given a fair opportunity to show its true value, or the want of it, in an appropriate way. On the contrary, the statute discloses a fixed purpose to secure timely notice to all claimants of every material step in the proceeding and full opportunity to be heard in respect of all that bears upon the validity, extent and priority of their claims. And while it is true, according to the concessions at the bar, that the sworn statements of claim are taken ex parte in the first instance, it also is true that they are then opened to public inspection, that opportunity is given for contesting them and that upon the hearing of the contests full opportunity is had for the examination of witnesses, including those making the statements, and for the production of any evidence appropriate to be considered. Thus the fact that the original statements are taken ex parte becomes of no moment. And while it is true that the state engineer's report is accepted as evidence, although not sworn to by him, it also is true that the measurements and examinations shown therein are made and reported in the discharge of his official duties and under the sanction of his oath of office, and that timely notice of the date when they are to begin is given to all claimants. The report becomes a public document accessible to all and is accepted as prima facie evidence, but not as conclusive.

* * * Considering the nature of the report and that claimants may oppose it with other evidence, it is plain that its use as evidence is not violative of due process. Meeker & Co. v. Lehigh Valley R. R. Co., 236 U. S. 412, 430.

The provision that the water shall be distributed in conformity with the board's order pending the adjudication by the court has the sanction of many precedents in the legislation of Congress and of the several states, notably in the provision in the Interstate Commerce Act directing the orders of the commission shall be effective from a date shortly after they are made, unless their operation be restrained by injunction. These legislative precedents, while not controlling, are entitled to much weight, especially as they have been widely accepted as valid. Although containing no provision for an injunction, the statute under consideration permits the same result to be reached in another way, for it declares that the operation of the board's order "may be stayed, in whole or in part" by giving a bond in such amount as the judge of the court in which the proceeding is pending may prescribe, conditioned for the payment of such damages as may accrue by reason of the stay. It is not, therefore, as if the requirements were absolute. As has been seen the order is made only after adequate notice and full opportunity to be heard, and when made is, with reason, deemed prima facie correct. It relates to flowing water, to the use of which there are conflicting claims. Unless diverted and used the water will pass on and be lost. No claimant is in possession and all assert a right to take from the common source. In this situation we think it is within the power of the state to require that, pending the final adjudication, the water shall be distributed, according to the board's order, unless a suitable bond be given to stay its operation. Such a requirement is not arbitrary, does not take from one and give to another and is not otherwise offensive to a right conception of due process.

RATES FOR ELECTRIC COOKING AND WATER HEATING.

(The question of the proper rates to be charged for this class of service is herein discussed and illustrated by several examples. This article is an excerpt from the report of the Electric Range Committee of the National Electric Light Association.—The Editor.)

The sub-committee on the above subject consulted with the same companies as the merchandising committee and secured the following information:

The companies replying served a population of 2,781,420 and have 195,353 urban residential consumers and 16,937 rural residential customers; climatic conditions varied from a maximum of 115 degrees Fahrenheit in summer to — 40 degrees in winter; the months in which heat is required in the home varied from 3 to 12; this plainly shows that each company must take these varying conditions into consideration in making rates for this business.

Approximately 47 per cent of the companies reporting have hydroelectric current only, 27 per cent steam, 13 per cent combination steam and hydroelectric plants and 11 per cent purchase current. The source of power has not, apparently, affected the rates made for electric cooking; however, flat rates for water heating are made almost entirely on the part of hydroelectric plants.

But little difference was noted in the prices of competing fuels as between urban and rural districts, which indicates that companies with large transmission lines serving both clases of territory should make the same cooking rates over the whole system.

Only two companies report their peak-load as occurring during daylight hours, the others report the peak between the hours of 5:00 and 8:00 p. m., and results obtained from cooking and water heating installations indicate that this peak overlaps or coincides with the previous system peak.

Approximately half of the companies report their district building up during 1915, and the others report their district stationary.

The companies report only 21 per cent as many electric water heaters in use as there are electric ranges.

Research work done by the committee indicates that the installation of an electric water heater in connection with the electric range reduces the average monthly current consumption of the range from 100 kw.-hr. to 80 kw.-hr., in other words, the range without separate water heaters heats enough water to increase the monthly consumption 25 per cent. The majority of the companies who have secured much water heating use the double-throw switch and find that the maximum kw.-hr. that a range can consume in a month to give satisfactory water heating flat-rate service for the average family is as follows:

Size Water Heater.	Kw.-hr. Cons. of Range.
600 watt	125
750 watts	150
1000 watts	200

A considerable number of the central stations are undecided as to the best method for handling electric water-heating and so have not made a special rate for this business.

One central station has concluded that water-heating at the flat rate of $3 per kilowatt-month, when operated in connection with an electric range and a double-throw switch used so that the heater is not in use with the range, results in a rate of one-half cent per kilowatt-hour.

The companies that have adopted water heating rates consider all such rates as experimental or development rates.

In considering the rate question for water-heating, one must realize with the use of double-throw switches that either the water heater, or the range is on the system peak and also that especially active or long hour range users, who also, presumably, are large water users, do not secure as much hot water from a flat-rate water heater operated with a double-throw switch as does the small or short-hour user of a range.

In considering the question of a combination lighting, cooking and water-heating rate, we face the difficulty of providing a rate which will properly protect the small user of light and yet provide an adequate return to the central station for lighting current furnished the larger homes and at the same time having a rate comparatively simple in form.

Some object to such a rate, especially in the development period of electric cooking, due to the advantages to both consumer and company of having separate bills for lighting and cooking, so as to determine cooking costs. Another serious objection is the difficulty of securing proper registration of lighting loads on a meter large enough to handle the electric range.

Some advantages of a combination rate are the eliminating of the possibility of a customer's having two meters installed securing lighting service on the range meter: the decided advantage such a rate offers in developing, in our customer's homes, the use of all kinds of appliances, small motors and air heaters, as well as encouraging longer hours' use of light; the keeping in service of the electric range all winter, whereas a separate minimum would result in the meter being taken out during the winter months if the coal range is used for heating the kitchen.

Most central stations are of the opinion that a cooking rate, which economically handles household cooking is sufficiently low to secure electric bake oven business in bakeries, restaurants, cafeterias and hotels, but that a lower rate must be made to secure commercial cooking, i.e., hotel and restaurant cooking where a considerable percentage of the cooking is not done in the oven. Such companies use their power rates for this purpose, the active demand of the range being used in determining the maximum demand charges of the power rate.

Two new rates adopted in the western territory since the Portland report are as follows:

Southern California Edison Company's Rate.

Combination Schedule for Lighting and Heating Service.

For all consumption of electric energy in residences and suites of apartments, through one meter, where an electric range is installed and used for cooking purposes:

(a) Houses of 8 active rooms and over, first 40-kilowatt hours per month, 7 cents per kw.-hr.

(b) Houses of 6 and 7 active rooms, first 30-kilowatt hours per month, 7 cents per kw.-hr.

(c) Houses of 5 active rooms and less and apartment house suites, first 20 kilowatt hours per month, 7 cents per kw.-hr.

For all energy used in excess of the number of kilowatt hours per month designated in any of the above classes, 3½ cents per kw.-hr.

Monthly minimum bill $2.50.

In classifying the houses supplied with service under this schedule bathrooms, halls and cellars will not be included as active rooms.

Pacific Gas & Electric Company's Rate.

The Pacific Gas & Electric Company, San Francisco, has issued a new rate schedule effective February 3, 1916, for electric cooking, heating and power, the rate applying in all territory except in the cities of San Francisco and Sacramento.

The new rate is based on the monthly consumption per meter and is as follows:

4.0c per kw.-hr. for first 30 kw.-hr. of active connected load.
2.0c per kw.-hr. for next 90 kw.-hr. of active connected load.
1.5c per kw.-hr. for over 120 kw.-hr. of active connected load.

Where the consumer signs a contract agreeing to take service for at least twelve consecutive months, the minimum charge will be $24 for each 12 months' period for the first five kilowatt or less of active connected load, and $12 per kilowatt for each kilowatt of active connected load in excess of 5 kilowatts. Minimum due and payable monthly.

Where consumer does not sign a contract for at least twelve consecutive months, the minimum charge will be $2 per month for the first 5 kilowatts or less of the active connected load and $1.00 per kw. for each kilowatt of connected load in excess of 5 kilowatts.

The active connected cooking, heating and power load shall be taken as 100 per cent of the first two kilowatts installed and 50 per cent of the connected load installed in excess of two kilowatts.

The consumer's wiring for electric cooking, heating and power must be separate from that supplying other service.

Both cases show a reduction as compared with their former rates for this class of business.

The feature of these new rates is the high minimum established and in both cases the minimum is below the normal bill if the range be active.

The following explanation from the Wilmington and Philadelphia Traction Company, of their cooking rate, is of especial interest as this form of rate has not been generally used.

"With an electric range, for instance the General Electric Type R stoves, on which the total connected load is 3.6 kilowatts, we have found that a demand of two kilowatts is very rarely exceeded. In fact our researches into electric cooking, which have extended over a period of some several years back, show that the ordinary household range, as above mentioned, can operate and do all the cooking without materially exceeding the demand of two kilowatts.

"It is generally conceded that with a three-cent rate on this type of range, the consumer's bill would be about $3 per month or that about 100 kw.-hr. per month would be the average consumption, and our preliminary researches show that this was practically correct.

"The normal demand on a range of this type, taken at about 60 per cent of the capacity of the range is approximately two kilowatts, as above stated.

"We make a contract with the customer, whereby he would pay us a flat rate of about $3 per month for the operation of this range, during such times as he is operating it at a demand of two kilowatts or less, and would pay a meter rate of 6c per kw.-hr. for the power which is consumed at a greater rate than two kilowatts. For instance, if he operated his range at a load of three kilowatts for less than one hour, his extra charge would amount to 1 kilowatt hour or 6 cents. In metering this service, we use a standard Westinghouse Type O A watthour-meter, with a special external attachment whereby we can accurately measure the kilowatt hours consumed over and above a predetermined demand.

"The advantages of the flat rate, plus excess schedule, for cooking and heating, are very evident.

"In the first place, a large portion of the rate is definitely determined and therefore can be billed in advance. In the second place a customer will endeavor to keep within the contracted for demand, which, of course, increases his load-factor.

"By the use of the flat rate principle for the first portion of the rate, you get away from the inconsistency of the individual operator, wherby one house will operate economically and have a bill of $3 whereas a neighbor would not operate economically and have a bill of considerably more. All of this has to be explained and studied out by the central station in order to keep the customer satisfied.

"With the flat rate principle, although one customer might have used a few more kilowatt-hours than another, and pay the same price for it, it is nevertheless true that each customer has the same privilege and could have used a greater or less amount at the same cost, provided they did not exceed the contracted for demand, and it is only the excess that causes the variation in cost. Of course, some customers contract for as little as one and one-half kilowatts; others contract for as much as the full capacity of the range, consequently they cannot have any excess, and we use the same principle in connection with all of our power business and have found it very successful.

"So long as a customer does not exceed the contracted for demand of two-kilowatts, one kilowatt or whatever the demand is they have selected, at the end of the month they only pay the price for the demand, which we base at the rate of $1.50 per kw. of demand contracted for."

Whether it is desirable to make the combination rate minimum in excess of $2 per month is questionable, as large minimums will tend to retard securing business.

The following table is herewith submitted to show the average daylight kw.-hr. consumption per residential consumer for a five months' period; also the average kw.-hr. per consumer during the hours of 6:00 a. m. and 6:00 p. m., and the average kw.-hr. per customer consumed during the hours of 6:00 p. m. and 6:00 a. m. It will be noted that a large quantity is consumed during daylight hours.

1915. month.	Average kw.-hr. per consumer.	Average kw.-hr. consumed from 6 a. m. to 6 p. m.	6 p. m. to 6 a. m.
August	13.98	6.58	7.4
September	14.78	5.7	9.08
October	17.95	7.18	10.77
November	21.3	9.8	11.5
December	23.95	11.0	12.95

In conclusion, we are of the opinion that no definite form of rate can be recommended for general use, since local conditions as to cost of current, cost of competitive fuels, forms of other rates, present practice in regard to cash discounts, attitude of regulating commissions, etc., will have to govern each central station in preparing rates for electric cooking.

We do not believe electric cooking in the average sized home can be secured on a three-cent rate; hotel, restaurant and large residence cooking will require a lower rate. A combination rate should be either a load factor rate or some modification, such as room rate, so as to protect present lighting earnings, and should have a minimum monthly bill, at least $2, and possibly larger.

LETTERS TO THE EDITOR.

Seattle Municipal Lighting Plant Losses.

Sir:—Referring to article in the Journal of Electricity, Power and Gas for May 13, entitled "Municipal Light Plant of Seattle Shows Loss for 1915" and, in perusing the figures set up, by the writer of the article, in connection with the operation of this plant, I wish to call your attention to what is a serious error in arriving at the deficit referred to.

The method of debiting Operating Expense with the redemption of the Capital Account, that is, the $71,000 for the redemption of bonds, is an error in setting up your account as you have to show this deficit. Does the writer of the article know of any public service corporation that is permitted to keep its accounts in this way? After debiting Operation with Depreciation and then making a further debit for the redemption of bonds, is going after Operation rather hard. By eliminating this erroneous charge of $71,000, the department does not show the loss referred to.

Is it not a fact that the Cedar River Dam, to which you refer relative to interest charge, was built as much for the use of the water department as for the light department of the city of Seattle? This being so, would it be fair to charge the interest on this investment entirely to the light department?

Relative to the rates for street lighting, is it not a fact that the Seattle rate is no higher than the average rates paid by Pacific Coast cities excepting possibly the municipal plants of Tacoma, Alameda and Riverside?

As a reader of your journal, I think that all of your readers are entitled to the facts in connection with this matter, and that you owe it to them to make the necessary corrections in the statements referred to.

Yours truly,

C. W. KOINER.

Pasadena, Cal., June 15, 1916.

Sir:—I have yours of the 16th instant with copy of letter from C. W. Koiner of Pasadena, criticizing the article which appeared in your May 13th issue, entitled "Municipal Lighting Plant of Seattle Shows Loss for 1915." I am glad to answer the questions which he has put up to you and give you the facts herewith.

The item of $71,000 paid out of the earnings of the Seattle municipal lighting department to redeem bonds in 1915 was not shown in the article as an operating expense by the writer, but was deducted from the balance after operating expenses had been taken out, to arrive at the net "balance for reserve and contingencies" and was so designated in the article. This net balance, of course, shows the true surplus available for dividends, new construction or betterments. One cannot eat his pie and still have it to eat at some future time. Mr. Koiner asks the question, "Does the writer of the article know of any public service corporation that is permitted to keep its accounts in this way?" The answer is, that the Public Service Commission of the State of Washington, requires every public service corporation in the state, under its jurisdiction, to arrive at the surplus for reserve and contingencies in this manner.

It is **not** a fact that the Cedar River dam was built as much for the use of the water department as for the lighting department. The bonds for this dam were voted by the people for the improvement of the lighting department power supply, and the interest on these bonds is paid out of the earnings of the lighting plant. The lighting department has never attempted in any way to saddle any of the dam charges onto the water department. No plans or schemes of the water department ever contemplated a dam at Cedar Lake for the extension of the water supply of the city. All such plans have figured on using Swan Lake, some nineteen miles below the Falls and past which the water supply pipe lines run, as a storage basin. The dam was built to raise Cedar Lake and create a storage basin for the lighting department, while the water department, not requiring a high head to operate its system, figured that it could at very little expense, at any time in the future, divert the Cedar River flow to Swan Lake, a natural reservoir basin, without incurring the large expense of a dam at the Falls, which was only necessary for the further development of the Cedar Falls power plant. But, during the past week, a committee appointed by the city council has recommended the expenditure of upwards of eight million dollars to improve the water supply of Seattle, and these improvements contemplate the use of Swan Lake as a reservoir, ignoring entirely the Cedar Falls dam as playing any part in the water supply system.

It is **not** a fact that the Seattle street lighting rate is no higher than the average rate paid by Pacific Coast cities. The truth is that almost without exception the street lighting rate of Seattle is the highest on the coast. On May 8, 1915, a committee appointed by the city of Spokane to investigate the desirability of establishing a municipal lighting plant in that city—the committee consisting of the commissioner of public works, corporation counsel, water superintendent and city engineer (the latter signing the report), all of them advocates of municipal ownership—submitted the result of their investigation. I quote as follows from their report:

"The price paid for street lamps in all the cities of the Pacific Coast, except Seattle, is around $60 per arc lamp per year. The city of Seattle is paying the highest rate for street arc lamps of any city in the Northwest, its price being 4½c per kilowatt hour for the current used. I find that the cost per arc lamp for the city of Seattle would be approximately $84 per year as against $48 paid in Spokane. This is the highest rate paid for lighting at any point that I have been able to locate out of 120 cities in the United States."

The arc lamps have very largely been discontinued and large nitrogen units substituted. These cost less to maintain than the arc lamps and yet the rate of 4½c is still being continued. The private company is furnishing street lights in 54 cities and towns around Seattle and in the Puget Sound country at less than the rate paid by the taxpayers of the city of Seattle to their municipal plant. There may be some cities in California paying a higher rate for their street lighting than that paid in Seattle, but there certainly are none in the states of Oregon or Washington.

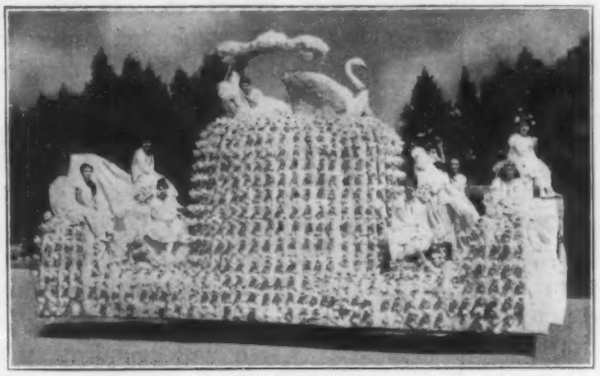
Yours very truly,

W. G. GRAMBS.

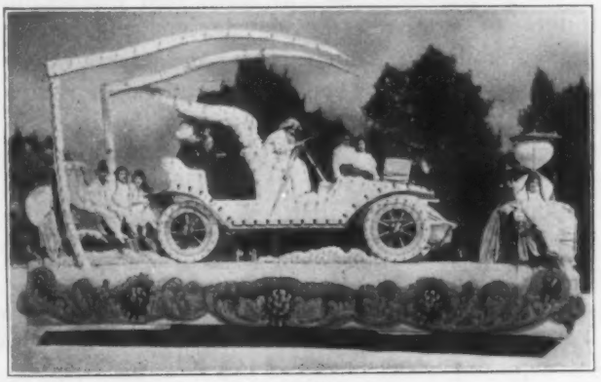
Seattle, Wash., June 20, 1916.

LOS ANGELES ELECTRICAL PAGEANT.

A splendid electrical pageant was presented at Los Angeles several times during the recent conclave of the Knights Templar. Sixteen beautiful floats, allegorically representing "The Flight of the Hours," from "Peep o' Day" to "Father Time," were mounted on trolley trucks furnished by the Los Angeles Railway and paraded through the city. The floats were designed by Fawcett Robinson and were equipped with many mechanical devices. J. L. Clark, superintendent of the electrical repair department of the Los Angeles Railway, had charge of the electrical features, with H. A. Heur as chief electrical inspector.



"Peep o' Day."



"Father Time."

Fish in irrigation ditches are bothering Forest Service officers, who say that thousands of trout placed in western streams by the Government are killed through being carried into the ditches and washed out on the fields. There are not less than 1200 irrigation projects on or near the national forests, and in many places the loss of trout is heavy. The amount of water used in irrigation, it is said, often determines the advisability of artificially stocking the streams. Where much of the water is used for irrigation, unless the ditches are screened, the trout enter and are washed out on to the fields. While fish are said to make good fertilizer, officials think that trout are too expensive to be used for that purpose.

Most of the states in the West have laws requiring that ditches be screened, but these laws are seldom enforced. The farmers are said to dislike the screens, because they collect drift—wood and trash—which prevents the free flow of the water. Very often, too, it is stated, the farmers can supply their families with a mess of fish by collecting the trout which are found in the fields.

TRANSCONTINENTAL WAVE TRANSMITTERS.

Through the courtesy of the Pacific Telephone & Telegraph Company a picture is shown herewith of the apparatus installed on a bluff near the Cliff House, San Francisco, to transmit the sound of the waves of the Pacific Ocean during demonstrations of transcontinental telephoning. At this point the roar of the waves can be picked up for transmission at any time during either high or low tide, and yet the apparatus is beyond the reach of the waves. The location was selected after several unsuccessful efforts, in one of which the entire apparatus was washed away, and in another the engineer was swept from the rocks. After excavating a portion of the rock a concrete pier was built as a support for a double iron box housing the three special transmitters used for this purpose.

Telephone Transmitter Recording the Roar of the Pacific.

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This issue of the Journal inaugurates a plan to hereafter give especial emphasis to irrigation matters.

Announcing an Irrigation Department

In the past, while no single periodical has allotted more space to the subject of Western irrigation than this journal, no regularity has been observed in its publication. Hereafter, this lack will be met by a regular department conducted under the direction of Professor S. T. Harding of the irrigation department of the University of California.

Professor Harding is well qualified for this work. He has had a wide practical experience in both government and private service, and combines with this the rare faculty of being able to impart his knowledge to others. Readers may confidently rely on his selection as to what is best in recent irrigation methods and practices.

The series of articles which will constitute this department will be concerned primarily with the use of power in irrigation and drainage and will include accounts of methods for developing underground waters, the design, construction and operation of pumping plants and the conveyance and use of pumped water. By this means not only will the irrigation engineer be given a new source of information, but the agricultural power salesman will find practical instruction on irrigation matters, thus enhancing his ability to interest irrigators in the increased use of electric power.

Electricity and irrigation are closely associated in nature. Storage of flood waters for the development of power also conserves the flow for irrigation needs. Hydroelectric power is largely responsible for the habitability of former arid areas now reclaimed by electric pumping. Electric power also has been of potent service in the reclamation of flooded or water-logged lands. So this additional matter in no way interferes but really assists in the Journal's established policy of helping to upbuild Western power developments.

Another nail has been driven into the coffin of the doctrine of riparian rights in Western states by the decision of the United States Supreme Court in upholding the legality of the Oregon water code, as is clearly pointed out by A. E. Chandler elsewhere in these columns. The conflict between the theory of riparian rights and the practice of prior appropriation has been long and bitter. Riparian rights, though economically weak, have been so strongly bolstered up by legal precedent that their position seemed well nigh impregnable. Consequently the victory in the Supreme Court greatly cheers everyone interested in the betterment of Western water law.

Legality of Water Appropriation

The doctrine of riparian rights is hyphenitic and not in accord with Pacific Coast conditions. It emigrated to this country after the common sense law of

prior use had been established by the early California miners. Under its enactment old titles have been insecure, distribution of water has frequently been inequitable and new developments have been retarded. Like the old man of the sea in the Arabian tale of Sinbad the Sailor, this pernicious doctrine has too long had a strangle hold on legitimate irrigation and power developments. It is high time to cast off the burden.

The Oregon statute went to the root of the trouble and provided a logical procedure for the adjudication of existing rights. After the state water board announces its findings of facts and issues a provisional order the entire matter is reviewed by the circuit court which issues the final order. In this respect the Oregon code provides a model which might well be followed by other Western states, now that its legality has been authoritatively determined.

Providing Boiler Safety

Last year more than four hundred steam boilers exploded in the United States, killing one-third that number of men and injuring nearly twice as many more. These casualties are criminal. Strictly speaking most of them were not even accidents, as the causes are known and the events could have been prevented by proper precautions.

Inasmuch as these precautions have not been voluntarily taken by some boiler owners and operators it has become necessary for the government to protect those who will not protect themselves, and others, against their own carelessness. Many of the Western states, particularly, have established industrial accident commissions to define and enforce standards of safety. The California commission has issued tentative boiler safety orders which are to be submitted for criticism and suggestion on July 8th at San Francisco, and on July 13th at Los Angeles.

These orders comprise the boiler code of the American Society of Mechanical Engineers, together with a few changes, affecting existing installations. They thus demonstrate the benefit to be derived from the labors of the boiler code committee, whose contribution to human welfare has hardly yet been appreciated. The rules provide for an annual inspection, and cover the subjects of inspections, ultimate strength of material used in computing joints, minimum thickness of plates and tubes, specifications of metals used in building boilers, construction and allowable working pressure for power boilers, riveting, calking, requirements for manholes and washout holes, safety valves, water and steam gages, fittings and appliances, hydrostatic tests and such. They apply primarily to stationary boilers of more than eight horsepower and do not govern boilers subject to federal control and inspection.

The most noteworthy feature of these orders is their agreement with standard practice. Practical considerations dictate that uniformity in rules be secondary only to the necessity for legislation. The absurdity of rating a given boiler as safe in one state and unsafe in another in manifest. While geography may modify the conditions to which engineering facts are applied it can never change those facts.

Interstate Transmission of Electrical Power

A most interesting example of how legal limitations may overrule possible equity is found in the decision in the case of the Washington Water Power Company against the Montana Power Company. As the case has to do with the interstate transmission of electric power it will possibly form a precedent for similar cases that may arise in other states.

It seems that the Montana Power Company and the Thompson Falls Power Company, both generating power in Montana, had arranged with several mining companies operating in the Coeur d'Alene district of Idaho, to transmit power from the Montana boundary line across Idaho over a transmission line owned by the mining companies. The Washington Water Power Company, operating an hydroelectric plant in Idaho and heretofore supplying these mining companies with electric power, then complained to the commission that they were thus subject to a form of competition to which the commission had granted no certificate of public convenience and necessity.

The commission neatly side-stepped the main issue by holding that the defendant power companies are not operating in Idaho and therefore are not subject to its jurisdiction and likewise that the mining companies do not come within its control as they are not public utilities. "However, a view of the fact that in the final determination of the case, the findings of the commission as to the character of the defendants may not be sustained, the commission deems it best to pass upon all the material issues raised so that the court may have all the issues before it."

Consequently, the commission finds that the transmission of electrical energy is a transaction of interstate commerce, over which it again has no jurisdiction. Still it does not necessarily follow that the distribution of such energy within the state of Idaho is interstate commerce, although the regulation of such distribution may affect interstate commerce. Nevertheless the commission recognizes that "to hold that electrical energy generated in Montana, or transmitted from Montana, can by reason of that fact be distributed in Idaho for compensation without regulation, while the local distribution of electrical energy generated in Idaho is subjected to regulation, is contrary to public policy."

Yet the commission finally finds that as the "distribution is made by the mining companies for their own use and not for sale to others, the transaction is not a public service under the jurisdiction of the commission." So the complaint was dismissed and the matter left to be taken up with the courts. The immediate lesson to be derived seems to be the necessity for specific legislation in the matter of extending or otherwise defining jurisdiction in such cases. Naturally it is not within our province to pass on the merits of either side's contentions at this time.

PERSONALS

Leonard Metcalf, consulting engineer of Boston, Mass., is at San Francisco.

R. Q. Cleavenger, Phoenix Glass Company of Pittsburg is at San Francisco.

Earl Wilson, electrical contractor and dealer at Napa, was at San Francisco this week.

D. A. Wagner, manager Electric Agencies Company, San Francisco, is at Los Angeles.

R. N. Tucker, contractor and dealer, Healdsburg, Cal., was at San Francisco this week.

E. D. Pike, manager of Coast Service Stations for the Wagner Manufacturing Company, is at Los Angeles.

H. D. Havey, salesman Electric Appliance Company, has returned to San Francisco from a trip in Nevada.

T. E. Bibbins, local manager of the General Electric Company, has returned to San Francisco from the East.

A. M. Irwin, assistant treasurer of the Westinghouse Electric & Manufacturing Company is at Los Angeles.

F. J. Cram, salesmanager of the Electric Appliance Company at San Francisco, is in camp on the Russian River.

Geo. Kidd, general manager British Columbia Electric Railway Company, Vancouver, B. C., has left for England.

T. H. Nelms, salesman for the Pacific States Electric Company, has returned from a short hunting trip in Marin county.

D. E. Harris, sales manager Pacific States Electric Company, at San Francisco, has left for the east for a month's trip.

Paul V. Quick, with Landers, Frary & Clarke, Universal Electric agents, at San Francisco, left for Salt Lake City this week.

M. A. Bryte, factory agent French Battery & Carbon Company, has returned to San Francisco from the Yosemite Valley.

B. W. Chenoweth, superintendent of plant, Philippine Island Telephone & Telegraph Company, Manila, is in San Francisco.

Wm. Hall of the National Conduit & Cable Company at San Francisco, is spending his vacation at the Yosemite with his family.

Duncan Reynolds of Holabird, Reynolds & Company, of Los Angeles, was in San Francisco on his way back from Del Monte.

H. C. McCutcheon, agent for the Holabird-Reynolds Electric Corporation at Los Angeles, is spending his vacation at San Francisco.

G. P. Egleston has recently been appointed new business agent for the Coast Counties Gas & Electric Company at Santa Cruz, Cal.

Arthur Noyes, salesman for Electric Appliance Company, has returned to San Francisco from a trip to Southern Oregon and Northern California territory.

H. P. Stow, general manager, and **Leo Harris,** of the Thomas Day Company, San Francisco, are making a business trip in auto through Southern California.

Edward D. Brown, superintendent Reno Water, Light & Power Company, was in San Francisco the first of the week, on his return from the Knigths Templar Conclave at Los Angeles.

Walter H. Whiteside, formerly president of the Allis-Chalmers Company, and now connected with the New England Westinghouse Company, was in San Francisco last week on his way home.

M. A. Hussey, E. C. Rounland, F. C. Carleton, salesmen with the Westinghouse Electric & Manufacturing Company, have been guests of the Camera Club at the Yosemite for the past two weeks.

C. W. Mitchell, inspecting engineer with the Board of Fire Underwriters of the Pacific, has returned to San Francisco from an extended trip through northern California, where special activity in dredge construction is noted.

W. P. Naser, manager for the Trumbull Electric Manufacturing Company at San Francisco, has been appointed manager of the company's branch office at Chicago, succeeding **J. S. Jacobson,** resigned. **H. F. Yost** is asssistant manager of the San Francisco office.

C. F. Benham, assistant to the superintendent of operation, Great Western Power Company, San Francisco; **N. H. Callard,** salesman Westinghouse Electric & Manufacturing Company, Salt Lake City; **J. H. Corcoran,** division superintendent of traffic, Pacific Telephone & Telegraph Company, Portland; **G. H. Kellogg,** gunner, U. S. Navy, Naval Training Station, San Francisco; **O. A. Kommers,** district agent, San Joaquin Light & Power Corporation, Corcoran, and **G. J. Wheat,** assistant to superintendent of operation and maintenance, Pacific Gas & Electric Company, have been elected associate members of the American Institute of Electrical Engineers.

MEETING NOTICES.

Oregon Electrical Contractors' Association.

The first quarterly convention of the Oregon association of Electrical Contractors and Dealers, was held at Portland on Wednesday, June 28th. The program for the day included open house for all members at the secretary's office during the morning, auto trip over the Columbia Highway during the afternoon, and a banquet at Crown Point Chalet in the evening. W. L. Goodwin of San Francisco, founder of the association, was to have been the principal speaker of the evening but was unable to attend.

San Francisco Electrical Development and Jovian League.

Preparedness was again the subject at the league luncheon on June 21st, ranging from discussion of plans for the preparednes parade on July 22 to a stirring address on "Government and Business," by Samuel M. Shortridge, the speaker of the day. He stated that business success and the security of human rights are dependent upon the stability of the government. He urged that business men should consequently take an interest in politics, arguing that the relation between government and business is so intimate that one cannot exist without the other. Mr. Shortridge is a wonderful speaker and impressed his auditors with the sincerity of his plea. H. H. Hoxie of the Electric Railway & Manufacturers' Supply Company, was chairman of the day.

Los Angeles Jovian Electric League.

A program of merit with full measure was provided at the luncheon on June 21st, by the chairman of the day, Thos. Foulkes of the Foulkes Electric Company. W. W. Middlecoff, a prominent attorney, in a snappy fifteen-minute talk, eulogized Electricity as the symbol of progress; his subject was "Electrifying the Law." He was followed by Dr. Sam Atkinson, secretary of the Motion Picture Freedom League, who delivered a lecture on "The Hyphenated American." He showed the difference between the citizen who was foreign born, but had become an American from choice, and the citizen who is an American as a result of the accident of birth. It is his opinion that in the event of an invasion, the foreign born will be just as determined to keep out the invader, as those who have not known another environment but that of this country. He stated that the result of future wars will hinge largely upon general industrial preparedness. In closing he said that the man who will do more to prevent an enemy from entering our country today, is not an army officer, a government official, or a politician, but an inventor—Thos. A. Edison.

Pacific Coast Electrical Jobbers.

Pacific Coast electrical supply jobbers and their guests met at Del Monte, June 21-24 to play golf and incidentally transact business.

As regards golf, the third and final match play for the team contest cup was won by the manufacturers. The Pass & Seymour cup was won by Floyd Averill of Portland; the central station cup donated by the jobbers was won by Stanley Walton and the old copper jobbers' cup, which has been the subject of contest for seven years, was won for the first time by C. E. Wiggin with 88 as a net score. The play for the manufacturers' trophy resulted in a tie between J. M. Morris of Los Angeles and T. E. Bibbins of San Francisco.

The several golf trophies, as well as the whist tournament prizes, won by Mrs. R. B. Clapp of Los Angeles and Mrs. Garnett Young of San Francisco, were presented at Saturday night's golf dinner, over which C. C. Hillis presided as toastmaster. The feature of the evening was the putting contest to decide the tie for the manufacturers' cup. Unfortunately Mr. Morris was unable to be present and as Mr. Bibbins plays only with left-handed clubs, it was necessary that only a left-hander could volunteer as a substitute. The honor fell to Sam Taylor. The contestants were forcibly removed from the banquet hall and donned full polo outfits. The contest was to be with polo mallets and polo balls. When the contestants entered the banquet room the guests stood upon their chairs and greeted them with shouts. Neither of the rivals, it seemed, had ever handled a polo mallet or seen a polo ball. Furthermore, Mr. Bibbins having traveled from Hot Springs, Va., to Del Monte to be present at this match, was somewhat fatigued and it was apparent from the start that he was nervous. The putting was fast and furious and at the finish Sam Taylor was declared the winner.

The open meeting Saturday afternoon was one of the most interesting ever held. H. V. Carter had secured as speaker Mr. Russell Lowry, president of the First National Bank of Oakland, Cal., who spoke on "Trade Acceptancy." Mr. Lowry's remarks were from a past master in finance. He said banks, while useful, are not wholly indispensable adjuncts of trade. Commerce in considerable volume was carried on before banks were thought of but the present method of business is almost entirely dependent upon banking accommodations. The constant problem of the commercial banker is to keep his investment liquid and he suggested a new form of commercial paper. The usual promissory note is not distinctively commercial, either in form or substance. Commercial paper which is sold through note brokers differs from the local credit only in that it seeks a wider market. The defect of the system is that there is always a broker willing to sell but no market when the holder wants to sell. As regards paper of a really commercial character this defect has been remedied by the Federal Reserve banks, which cash notes by the process of re-discounting. Notes representing non-commercial transactions still remain unavailable, except by sale or as collateral with correspondent banks. The four or six months' term of credit for single name commercial paper is also too long. In Europe the note is drawn to approximately cover the period necessary for the shipment of goods and their sale by the purchaser. In America, on the other hand, the term of credit has lengthened, while the time consumed in moving goods has been decreased with better transportation methods.

An even greater lack of convertibility is found in mercantile credits carried on open account than is the case with bank credits. In Europe the open account is replaced by the bill of exchange or sight draft with bill of lading. When these documents are presented, the purchaser detaches the bill of lading and writes the word "accepted," with his signature, across the face of the draft, which then becomes a bill of exchange discountable at the bank and thereby convertible into cash.

"A bill of exchange is superior to the promissory note, as we know the latter, in having behind it the responsibility of the maker, the responsibility of the acceptor, and a specific shipment of goods, which presumably are to be resold during the life of this instrument and thereby provide the means of payment.

"Granting that trade acceptances or bills of exchange, or two-name paper by any other name you may prefer, is preferable as a means of settling accounts to ledger entries, what can we do to bring about the desired change in our methods? Most of our two-name paper at present is the poorest paper we have because it represents merely the closing of overdue or doubtful accounts. There is an undoubted prejudice in the minds of business men against signing notes or accepting drafts. They seem to think it is an imputation upon their credit to be asked for paper. This prejudice must be overcome before any real progress is made, and it is not likely business men will exert themselves very greatly to educate their customers unless there is something to be gained by so doing. Here is where the co-operation of the banks must come in. If the banks will say to their borrowing customers, 'We will charge you such and such a rate for your loans, but if you will convert your book credits into negotiable instruments, we will discount these instruments at 1 per cent less than the rate for loans,' an inducement is supplied.

"But there is another aspect to the situation, much more important than the consideration of reducing the costs of business. The creation of the Federal Reserve banks places at the service of trade and commerce not merely a large aggregation of detached and independent banks, but a great banking system—a system whose life blood is commercial paper of the most liquid nature. The ability of this system to serve in fullest measure is dependent upon the volume of the stream of commercial credits which it is able to regulate and influence. The Federal Reserve banks are the reservoirs of credit which absorb the excess volume when the stream is at flood, releasing it gradually as the flood subsides and so keeping an even and dependable flow. How can this be done if business men, mindful only of their own immediate interests, refuse to contribute their quota toward the establishment of a credit system in line with those of other countries, and leave the streams and reservoirs of banking credit dry and barren? Could the Bank of England, during the month of August, 1914, have expanded its loans $300,000,000, with reserves lowered from 55 per cent to 15 per cent, if there had not been available for discount a broad volume of really commercial paper, known to be liquid in normal times and unquestioned as to value by reason of the strong business houses behind it? And what can the National banks do, in times of emergency, to tap the reservoirs of the Federal Reserve banks, unless proper tapping facilities are furnished by business men, through conversion of their inaccessible credits into liquid and negotiable form?

"The Federal Reserve banks have done their part in offering a lower rate of discount on trade acceptances than on single-named commercial paper, thereby emphasizing the greater desirability of this class of investment."

A very earnest discussion of Mr. Lowry's address then followed and it seemed the consensus of opinion was in favor of working the problem out on a commercial basis. Geo. C. Holberton then addressed the meeting on the subject of co-operation of the jobbers and central station, not only in merchandising for electrical lines but also for gas. The jobbers very heartily offered to perfect a plan of operation with him at once.

Those present included Mr. and Mrs. F. H. Leggett, Mr. and Mrs. R. B. Clapp, Mr. and Mrs. A. H. Elliott, daughter, and Miss Bunnell, Mr. and Mrs. J. C. Manchester, H. B. Squires and mother, Mr. and Mrs. Garnett Young, F. N. Averill, F. G. Beck, R. F. Behan, W. L. Berry, T. E. Bibbins, T. E. Burger, H. V. Carter, H. T. Clark, R. J. Davis, Ira Francis, S. W. Gil-

man, W. L. Goodwin, W. L. Greenfield, S. B. Gregory, W. B. Hall, C. C. Hillis, R. D. Holabird, Geo. C. Holberton, Russell Lowry, H. C. McCutcheon, J. M. Morris, F. H. Murray, F. J. Quinn, S. P. Russell, D. L. Reynolds, H. E. Sanderson, H. B. Squires, E. B. Strong, S. H. Taylor, S. V. Walton, C. E. Wiggin, Carl Young and Garnett Young.

National Electrical Contractors' Association.

The sixteenth annual convention of the National Electrical Contractors' Association of United States, will be held at New York City, July 17th to 22d, inclusive. An electrical exhibit will be held under the management of the Hotel McAlpin during convention week in the terra cotta room of the hotel.

Monday, July 17th—10 a. m.: Meeting of national executive committee.

Tuesday, July 18th—10 a. m.: Meeting of national board of directors.

Wednesday, July 19th—10 a. m.: Opening of convention. Session open to all. Speakers: Address of Welcome, Lewis H. Woods, president New York State Association; response, John R. Galloway, president N. E. C. A.; address, Hon. John Purroy Mitchell, mayor of New York City; address, James H. McGraw, president McGraw Publishing Company, subject, "Electric Merchandising"; address, T. Commerford Martin, executive secretary, N. E. L. A.; address, Arthur Williams, general inspector New York Edison Company.

2 p. m.—Business session. Open to members only.

9 p. m.—Reception and dance—blue and green rooms, Hotel McAlpin.

Thursday, July 20th—10 a. m.: Business session. Open to all in the electrical contracting business, whether members or not.

10:30 a. m.: Ladies to visit and inspect "Altmans."

2:00 p. m.: Business session. Members only.

2:30 p. m.: Complimentay concert tendered to ladies and guests of the Aeolian Company at Aeolian Hall, Forty-second street, introducing the organ, pianola and talking machine.

5:30 p. m.: Automobile trip to Coney Island.

Friday, July 21st—10 a. m.: Business session for members only.

3 p. m.: Special train on Long Island road, leaving Pennsylvania Station, to Hotel Trouville, Long Beach.

4 to 6:30 p. m.: Surf bathing, etc. at Long Beach.

6:30 p. m.: Dinner-dance and entertainment.

Saturday, July 22d—9 a. m.; Organization meeting of the national board of directors.

10 a.m.: Organization meeting of the national executive committee.

11 a. m.: Leave hotel for special boat, "Seeing New York by Water." A light luncheon will be served on board, landing about four o'clock.

TRADE NOTES.

The Mosso-Berry Electrical Construction Company has changed its name to the Hutton-Tinling Electric Company of Spokane, due to the fact that H. H. Hutton and Hugh. L. Tinling are now in active charge.

Holabird-Reynolds Electric Company have just moved to a new location, 300-302 East Third street, Los Angeles, occupying the entire new building that was built especially for them. This will give about twice the amount of floor space formerly occupied.

The prize washing machine campaign conducted by the Pacific Power & Light Company during the three months ending May 31st, was won by the Prosser office, which sold machines to 3 per cent of its consumers. The total number of machines sold was 118, of which 20 were sold by Norman H. MacDuff of the North Yakima office.

CALIFORNIA WATER COMMISSION APPLICATIONS.

J. W. Catlett of Pleasant Grove, Sutter county, has applied to the commission for permission to appropriate 400 miners' inches of the waters of the east by-pass of Reclamation District No. 1001, tributary to the Sacramento River. It is intended to divert the water by means of a concrete flume, with removable flash boards. A canal a half a mile long will convey the water to the lands to be irrigated, which comprise 1280 acres.

The Ivanpagh Valley Improvement Company of Pasadena has applied to the commission for permission to appropriate the surface and subterranean waters, to the amount of two second feet, of Cliff and Boulder Canyon Creeks in San Bernardino county tributary to Dry Lake in Ivanpaugh Valley for irrigation purposes. The applicant proposes a pipe line 2½ miles in length, into which the water will be diverted by dams in tunnels under the gravelly bed of the stream. The estimated cost is $10,000. The acreage to be irrigated is 8000.

W. J. and P. S. Dorris of Alturas have applied to the commission for permission to appropriate 550 acre feet of the waters of Government Corrals Flat, tributary to Rattlesnake Creek in Modoc county. An earth dam 443 ft. long is proposed to divert the water to 400 acres at an estimated cost of $1100.

Harry Pattison of Crescent City, has applied to the commission for permission to appropriate three second feet of the waters of Haden Gulch, tributary to Hurdy Gurdy Creek, in Del Norte county for mining purposes at the Lucky Strike mines. A ditch ¾ mile long is proposed to convey the water to the mines at an estimated cost of $1000.

The American Trona Corporation, of Trona, San Bernardino county, by S. W. Austin, its attorney in fact, has applied to the commission for permission to appropriate for mining purposes, the waters of Peterson, Argus, Bruce Canyon and Parson Creeks in Inyo county, on the east slope of Argus Mountains. While this application asks for the appropriation of only one half of one second foot of water, its system proposes the use of over 22 miles of pipe line, and an estimated expenditure for getting the water to place of use of some $8000, which does not include a great deal of work already done and money expended. The nature of the mines to be supplied are potash, borax and soda. The water is to be developed by open pipes and tunnels at eighteen different points and collected in tanks and reservoirs at the mines.

Flory, Culp & Flory of Fullerton, Orange county, have applied to the commission for permission to appropriate the storm water of Black canyon in Mono county for the purpose of irrigating 480 acres of land.

E. H. Dodge of San Francisco, has applied to the commission for permission to appropriate 500 cu. ft. per second of the waters of Lee Vining Creek, in Mono county, for irrigation purposes. The application states that it proposes to construct a main canal 20 miles in length and to water 50,000 acres at an estimated cost of $200,000. The application covers lands around Mono Lake.

The city of San Luis Obispo has applied to the commission to appropriate five cubic feet per second of the waters of Lopez Creek, tributary to Arroyo Grande Creek for a municipal water supply. Also, that municipality applies to appropriate 8 second feet of Salinas River for like purpose. According to the application it will require nearly 20 miles of pipe line to carry the water from points of diversion to the city.

Some time ago Barclay McCowan of Bakersfield filed an application with the commission for permission to appropriate 10,000 second feet of water in Kern county and has followed it with another for 25,000 cubic feet additional from the Kern River, with a storage of 750,000 acre feet. McCowan states that he is filing for trustee for the people of

Kern county, with the intention of forming a large irrigation district under the state laws. The last application involves 21 townships of nearly 500,000 acres.

A. D. Schindler of San Francisco has filed three applications for permission to appropriate water, with the commission, involving an irrigation district covering 250,000 acres. at a cost if carried out of several millions of dollars. Applicant asks 2000 second feet from the South fork of the Kings River, 2000 from the main Kern River, and 1000 from the Tule and Kaweah Rivers, a total of 5000 second feet, and storage of 300,000 acre feet. The proposed main canals are 90 miles in length. The land to be irrigated all lies in what is known as the Tulare Lake Basin and the application states that it is the intention to form a district to be known as the Tulare Irrigation District.

Wm. M. Cunningham of Topaz, Mono county, has applied to the commission for permission to appropriate for irrigation purposes, four second feet of the waters of Sliknard Creek tributary to West Walker River in the said county. Applicant proposes to convey the water a mile and a half through a ditch to the land to be irrigated.

E. J. Prior of Big Bar, Trinity county, has applied to the commission for permission to appropriate five second feet of the waters of Manzanita Creek, tributary to Trinity River, for mining purposes. Applicant proposes a ditch 3700 ft. long to convey the water to a gravel mine, at an approximate cost of $500. The water will be returned to Trinity River.

Richard Clayton of Bodfish, Kern county, has applied to the commission for permission to appropriate three second feet of the waters of Erskine Creek, tributary to Kern River for irrigation purposes. He will carry the water diverted to the land to be irrigated by a ditch approximately a mile in length.

Permits.

George Allen of College City, Colusa county, has been granted a permit by the commission to appropriate three second feet of the waters of Reclamation District Ditch No. 108 in that county, for purposes of rice culture. By means of a pumping plant raising the water six feet to a ditch to be a quarter of a mile long, he will irrigate 136 acres.

Thomas Quigley of Gottville, Siskiyou county, has been granted a permit by the commission to appropriate eleven second feet of the waters of Beaver Creek for power purposes. The total fall to be utilized is 80 ft. to develop 160 theoretical horsepower for the purpose of operating a gold dredger. The water is to be carried to the works through a ditch two miles long. Water will be returned to the stream after use. The estimated cost is $1000.

G. W. Pratt of San Francisco has been granted a permit by the commission to appropriate three second feet of the waters of Sycamore Slough in Reclamation District No. 108 for purposes of rice growing, in Colusa county. By a ditch a quarter of a mile long the water will be brought to 250 acres at a cost of $1000.

G. W. Layman of Los Angeles has been granted a permit by the commission to appropriate one second foot of the waters of springs in Arctic Canyon, San Bernardino county for irrigation. It is proposed to carry the water through a ditch five miles long to 320 acres at an estimated cost of $3000.

Elmer E. Mason of Straw, Modoc county, has been granted a permit by the commission to appropriate fifteen acre feet of the run-off of Clear Lake Hills for the purpose of irrigating 30 acres at a cost of $650.

Ernest A. Schuler of Balls Ferry, Shasta county has been granted a permit by the commission to appropriate five second feet of the waters of Sheridan Creek, tributary to Bear Creek, Shasta county, for irrigation. By a ditch two miles long it is proposed to carry the water to 640 acres to be irrigated, at an estimated cost of $750.

Samuel P. Hale of San Jose has been granted a permit by the commission to appropriate 4.4 second feet of the waters of Jackson and Hale Creeks in Fresno county for irrigation purposes.

Geo. T. Neasham and E. L. Kafader of Ft. Bidwell, Modoc county, have been granted a permit by the commission to appropriate three cubic feet per second of the waters of Lieberman Creek, tributary to Upper Lake in Surprise Valley, for irrigation purposes. A ditch 3½ miles long will carry the water to 3000 acres at a cost of $1200.

Joseph H. and Laura B. Meredith of Willow Ranch, Modoc county, have been granted a permit by the commission to appropriate 115 acre feet per annum of Bonner Ravine, tributary to Goose Lake in Modoc county, for irrigating purposes. The water will be carried to 115 acres at a cost of $1000.

The Frank Shaw Land & Cattle Company of Bishop, Inyo county, has been granted a permit by the commission to appropriate 1110 acre feet of water per annum of Dexter Creek in the county of Mono for irrigation of 1680 acres by means of a ditch two miles long, at at estimated cost of $6500.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The commission has authorized the Santa Maria Gas & Power Company to issue and sell $40,000 face value six per cent twenty year gold bonds. The money will be used for construction purposes.

The commission has approved a form of mortgage and trust deed filed by the Southern Counties Gas Company of California, to secure an authorized bond issue of $10,000,000.

The San Joaquin Light & Power Corporation has applied to the commission for authority to issue and sell $1,000,000 par value first and refunding mortgage series C 6 per cent bonds to reimburse treasury for moneys expended in betterments.

The commission has authorized the Los Gatos Telephone Company to sell 150 shares of its capital stock at $10 a share to take up certain outstanding notes.

The Nevada, California & Oregon Telegraph & Telephone Company has applied to the commission for authority to issue $15,000 6 per cent bonds at 80 per cent of par to raise $12,000 to build toll line 25 miles long in Modoc County.

The commission has authorized the Northern Electric Railway Company—Marysville and Colusa branch—to issue its demand notes for $25,000 at 6 per cent, to take up similar note to the First National Bank of San Francisco. It has also authorized the Northern Electric Railway Company to issue its demand note for $185,000 at 7 per cent to take up same amount of notes to various banks.

The commission has issued a supplemental order authorizing Western States Gas & Electric Company to withdraw from the Girard Trust Company $8069.38, part of a trust fund to pay for extensions and betterments.

The San Diego Consolidated Gas & Electric Company and the Oceanside Electric & Gas Company have filed with the commission a joint application for authority for the former to buy, and the latter to sell, all property and rights of the Oceanside Company. The commission heretofore authorized the San Diego Company to buy the entire issued capital stock of the Oceanside Company, 1819 shares, at $14 a share, and the San Diego Company now says it holds 1699 of these shares and expects to acquire the remaining 120. When this ownership is completed it wishes the property of the purchased corporation conveyed to it.

NEW CATALOGUES.

Westinghouse Motors for Washington Machine Service is the subject of No. 25 in the small motor series published by the Westinghouse Electric & Manufacturing Company.

ELECTRICAL CONTRACTS—PORTLAND, OREGON.

The Morrison Electric Company has the following contracts: Portland Rubber Mills, 368 E. Ninth street; Glafke Warehouse, E. Third and E. Elder streets, reconstruction work for the True Blue Biscuit Company, 414 E. Davis street; Portland Camera Exchange, 386 Morrison street; Freedman Estate Building, Ninth and Davis streets.

Pierce-Tomilson Electric Company is doing the re-construction work in the old Rambeau Grill at 127 Broadway street.

F. H. Bauman Company wired the new building of the Oregon News Company, 440 Glisan street.

Miller & Halls have the complete electrical contract for both power and light in the electrically driven sawmill being built by the Inman, Paulson Company, Portland, Oregon. In addition to this they have the contract for the electrical equipment of the Wassell Apartments, being constructed at Fourteenth and Clay streets. There will be 53 apartments, each equipped with electric ranges. At the present time they are completing the wiring of the new municipal warehouse No. 1 and a garage on the corner of Broadway and Davis streets,

Vanderlip & Lord have the contract for the wiring in the building being erected on the northeast corner of Ash and Third streets, also F. Lowengart's building at 380 Couch street, and White Company's building, west Park and Couch streets.

The Beauer Electric Company is installing the electric system in O. B. Stubb's Building on the northeast corner of Couch and Fourth streets.

The Coast Steel and Machine Company is installing the electrical equipment in the new building being erected by the Kaola Company at 634 Roosevelt street.

The Ne Page, McKenny Company are doing the electrical work in connection with the remodeling of the Pantages Theater.

C. M. Reardon is doing the electric work in connection with the remodeling of the Orpheum Theater, which is to be now known as the Hippodrome.

BOOKS RECEIVED.

"The Electrical Contractor," by Louis W. Moxey, Jr. 86 pp., 6x9 in. Published by McGraw-Hill Book Co., New York, and for sale by Technical Book Shop, San Francisco. Price, $1.50.

Herein are presented the essential principles of cost-keeping and estimating, wiring and illumination calculations and other technical problems met by the electrical contractor. They represent the results of twenty years' practical experience. The book contains eight chapters, devoted respectively to profit and overhead expense, bookkeeping, cost-keeping, estimating, calculating wire sizes for both d.c. and a.c circuits, illumination calculations and general data. Any contractor will find this information to be worth many times the cost of the book.

Walker's Manual of California Securities and Directory of Directors. 586 pp., 6x9 in. Published by H. D. Walker, 454 Montgomery street, San Francisco, and for sale by Technical Book Shop, San Francisco. Price, $4.00.

The eighth annual number of this standard guide to financial conditions in California, in addition to giving full details as to the bonded indebtedness of the state and three principal cities, list of banks, public service corporation officials, stock and bond issues, and similar information for sugar and oil corporations, for the first time contains a section devoted to irrigation securities. An exhaustive table is also presented of the San Francisco street railway franchise situation, as well as a record of quotations on the San Francisco exchange from January 1, 1905 to April 30, 1916. Brief articles are published on the blue sky laws and the regulation of public utilities.

Standard Methods of Gas Testing, 200 pp., 6½x10 in. U. S. Bureau of Standards, Washington, D. C. Price, 40 cents.

How to measure, determine and test gas for illuminating and heating purposes is here set forth in simple form, technically correct. After suggesting the best location and general equipment of a laboratory, attention is given to the measurement of gas volume by various kinds of meters. Then follows detailed instructions as to the measurement of heating values and the determination of candle power and gas impurities. Meter testing and determination of specific gravity and humidity complete the volume.

"Electrical Engineering," by E. J. Berg and W. L. Upson. 416 pp., 6x9 in. Published by McGraw-Hill Book Co., New York, and for sale by Technical Book Shop, San Francisco. Price, $4.00.

This volume is based upon lectures in the first course of electrical engineering at Union College, Schenectady, where the authors are professor and associate professor respectively. The purpose is to supplement class-room instruction, recitation and laboratory work by fixing fundamental ideas. This is done primarily by means of problems, typical solutions being given. The treatment is fundamentally concerned with design of motors, generators, lifting magnets and transformers. The principles of each type of apparatus are clearly developed. The mathematical treatment is simply explained, particularly as regards alternating current transmission problems. It is unfortunate that a number of typographical errors in formulas mar the otherwise precise excellence of the work. As a whole, it is particularly well adapted to individual study by engineers who desire to brush up on elementary theory and be informed on the latest developments in electrical engineering.

"The Engineer in War," by P. S. Bond. 187 pp., 5x7½ in., black leather binding. Published by McGraw-Hill Book Co., New York City, and for sale by Technical Book Shop, San Francisco. Price, $1.50.

This text is the latest addition to the rapidly growing literature regarding the unpreparedness of the United States for military emergency. But unlike many other books, it suggests a practical remedy, particularly as regards the service of engineers, by outlining the essentials of a course of training for an engineer reserve. It is in effect a brief outline of the relation of engineering to the conduct of war and the adaptation of the principles and practices of civil engineering to military requirements. The author is major of the corps of engineers, U. S. A., this book being a reprint, with revisions and additions, of a series of articles published in The Engineering Record. The subject matter is divided into eleven chapters. First the military policy of the United States is shown to be behind the times, particularly as regards engineer troops, whose duties are outlined and whose equipment is described. The application of these principles are then illustrated by description of methods employed in crossing streams, by pontoons, bridges and fords, building military roads, carrying on field fortifications and siege operations, and demolishing bridges, railroads and highways. A chapter is devoted to military reconnaissance, sketching and surveying, one to military sanitation and another to the mobilization of material resources. The final chapter tells how engineers and contractors may prepare to meet the military obligations of citizenship by means of study and field training. Then, by examination, engineers can qualify for commissions in the volunteer engineers. The war department's suggested list of military reading for civilian engineers is published as a bibliography. There is also a glossary of military terms employed in the text. From this outline it will be noted that this book forms a most valuable introduction to detailed study of the general subject of military engineering.

NEWS NOTES

INCORPORATIONS.

BIG SANDY, MONT.—The Farmers' Mutual Telephone Company has been incorporated here.

BELLEVUE, IDAHO.—Articles of incorporation have been filed for the Glendale Farmers' Mutual Telephone Company.

SANTA FE, N. M.—The Rosa-Ignacio Telephone Company, organized under the laws of Colorado to operate a phone line betwee Rosa and Ignacio, Colorado, has been admitted to do business by the state corporation commission. The capital is $10,000 and Alfred H. Long of Rosa is named statutory agent in New Mexico.

ILLUMINATION.

BRAWLEY, CAL.—A new lighting system will soon be installed in Brawley by the Holton Power Company.

GRESHAM, ORE.—A franchise has been granted to the Portland Gas & Coke Company for supplying Gresham with gas.

SPOKANE, WASH.—The council has declared intention to install an ornamental lighting system on Main street from Division to Monroe streets.

UNIONTOWN, WASH.—This city is expected to install a street lighting system. The Washington Water Power Company is rebuilding its lines through this place.

EL PASO, TEXAS.—The building committee of the Mt. Sinai temple has awarded the contract for electrical fixtures for the new synagog to the Lawrence Electrical Company.

CERES, CAL.—A contract for lighting the streets of Ceres for five years has been awarded to the Yosemite Power Company. The company is to install a new system under the contract.

STANWOOD, WASH.—Warner Marshall of Boston appeared before the council recently with a proposal to take over the Stanwood Light & Power Company if the city would give him a franchise.

LOS ANGELES, CAL.—The city attorney has been instructed by the council to prepare a contract for cable for use in the lighting systems at Echo and Sycamore Grove parks with the Standard Underground Cable Company.

NEWPORT BEACH, CAL.—The board of trustees has bought the artificial gas generating plant from the bondholders of the West Coast Gas Company and has leased the distributing system within the city and on Balboa Island.

SAUSALITO, CAL.—A contract has been entered into with George L. Fish to install a gas distributing system. The rate is not to exceed $1 per 1000 ft. It is thought the system will in the course of time be extended to Belvedere, Tiburon and Mill Valley.

HAYWARD, CAL.—The chamber of commerce has appointed Victor Lagrave, Jesse H. Woods and H. Holmes a committee to confer with the town trustees regarding the inauguration of an electrolier lighting system on the principal business streets.

CALEXICO, CAL.—It is stated that the new power plant of the Holton Power Company will be completed within 30 days. In addition to the new plant near Holtville, the company will have its gas and electric reserve plants at El Centro completely renovated and remodeled, greatly improving its equipment and service in the valley.

EL PASO, TEXAS.—The Parsons Gold Mining & Milling Company has purchased the Alto Light & Power Company's light and power plant, and will operate it on a much larger scale than formerly. They are preparing a foundation for a new 500 kw. turbine and for other machinery to be installed. The plant will continue to be operated under the name of the Alto Light & Power Company.

FRESNO, CAL.—About 6200 ft. of laterals from the gas main in Arlington Heights will be laid by the Pacific Gas & Electric Company, through the Alta Vista tract as one of the extensions that are contemplated in their $20,000 estimates for improvements in Fresno. A 4 in. main will be laid from Seventh to Eighth streets on Ventura. Two 125 h.p. boilers in the west Fresno plant will be replaced by one 450 h.p. boiler at a cost of about $13,500.

TRANSMISSION.

PRINCE GEORGE, B. C.—Sealed proposals for equipment for the power plant will be received by the city clerk, John A. Turner, up to July 8th.

LENOX, MONT.—It is reported the Helena Light & Railway Company of Helena plans the extension of its electric-lighting lines to Lenox. W. L. Callaghan is manager.

WOODLAND, CAL.—The Northern California Power Company has applied for a franchise for transmission lines in Yolo County. Bids will be received for said franchise up to July 11th.

OAKLAND, CAL.—Representatives of the Glen View and Montclair Improvement Clubs have appealed to the city council to have the wires of the Great Western Power Company placed underground in the Fourth Avenue Heights district.

OAKLAND, CAL.—The Pacific Gas & Electric Company has laid a high power electric cable carrying between 3000 and 4000 horsepower under the estuary immediately east of the Southern Pacific drawbridge to furnish power for the plant of the Union Iron Works on the Alameda side of the estuary.

KINGMAN, ARIZ.—Surveying of a new power line 8 miles in length to run north from Gold Road vicinity and tap the Union Pass district, has been started. The company also contemplates the construction of a line about a mile in length to supply power to the Pioneer and Paramount mines near Oatman.

SALT LAKE CITY, UTAH.—The Utah Power & Light Company is constructing a transmission line, which begins at Springville and will end at the Mohrland and Blackhawk mines in Carbon county. The line will run by way of Helper and will be approximately 100 miles in length. The cost will be in the neighborhood of $500,000.

FRESNO, CAL.—The San Joaquin Light and Power Company is preparing to make extensions in the Fresno district that will cost approximately $75,000. It is reported that about 65 miles of new lines will be put in, divided as follows: Fresno, 10.3 miles; Selma, Caruthers and Riverdale, 9 miles; Midway, 7½ miles; Corcoran, 3¾ miles; Bakersfield, 5.2 miles; Madera, 4.8 miles; Dinuba, 2.3 miles; Merced, 3.6 miles; Livingston, 5 miles; Los Banos, 6 miles; Santa Maria, 7 miles.

WILLIAMS, CAL.—Local employes of the Northern California Power Company have figured the cost of the proposed extension from Arbuckle to Dunnigan at $20,000. The voltage between here and Arbuckle will be raised from 6,600 to 11,000, making it necessary to enlarge the transformers at Arbuckle. The line at present ends at College City, three and a half miles east of Arbuckle. This will have to be practically rebuilt on account of the higher voltage. Ten and a half miles of new line will have to be built from College City to Dunnigan.

OCEANSIDE, CAL.—A. S. Glasgow, resident manager of the Oceanside Electric Company, announces that in addition to the installation of a 24-hour service of electric current in Oceanside, important improvements are to be made in connection with the operation of the plant under the new man-

agement of the San Diego Consolidated Gas & Electric Company. Surveys have been completed for building a line from the end of the San Diego company's present power line in Del Mar to Oceanside, material for which has been purchased. It is expected that the Del Mar-Oceanside line will be completed by August 1st.

THOMPSON FALLS, MONT.—It is reported that by September 1, 1916, the Holter plant of the Montana Power Company, near Thompson Falls, Mont., will be furnishing not less than 50,000 h.p. It is understood the third and fourth units are now being installed, and that each of the six units which will comprise the completed plant will furnish 6250 kw. The work is being rushed at the plant, and plans for the construction of a high-power transmission line up Cow Creek and over the divide to Saltese are being prepared. The line to Saltese will supply current for operation of trains over the line of the Chicago, Milwaukee & St. Paul Railway Company.

SPRINGFIELD, ORE.—The board of directors of the Oregon Power Company has authorized the construction of an electric transmission line which will connect the system in Marshfield, Ore., with Coquille and Myrtle Point, two towns which were added to the Coos Bay (Marshfield) Division of the company about two years ago. This transmission line will traverse a distance of about eight miles between Coquille and a lumber camp of the C. A. Smith Company, now served electrically by the company over wires owned by the former. Arrangements have been made with the lumber company to use their seven-mile transmission line in conjunction with the company's extension from Coquille to connect the two at present separated systems of the Coos Bay division of the power company. When completed the electrical requirements of Coquille and Myrtle Point will be served from Marshfield, a distance of fifteen miles, and the steam plant located at Coquille will be dismantled.

TELEPHONE AND TELEGRAPH.

FORT BRAGG, CAL.—The district commercial manager of the Western Union Telegraph Company says the company will build new lines to accommodate growing business in this city.

ALTURAS, CAL.—The Nevada, California and Oregon Telephone & Telegraph Company is preparing to build a toll line between Alturas and Cedarville, a distance of 25 miles, at a cost of about $12,000.

RIVERSIDE, CAL.—O. P. Clark has applied to the board of supervisors for a franchise for the California Southern Railroad Company for a telephone line on highways of this county. Bids will be received up to July 26th.

TRANSPORTATION.

EAST SACRAMENTO, CAL.—The Pacific Gas & Electric Company is preparing for the double tracking of the J street car line east of Clark avenue. The double track system is to be installed on J street to Hale avenue in advance of the street improvement.

SILVERTON, ORE.—It is reported that the Silver Falls Timber Company will electrify its railroad from Silverton to its logging camps and that the Willamette Valley Southern, financed by the Portland Railway, Light & Power Company, will be extended to Silverton before another fall.

LINDSAY, CAL.—Officials of the Pacific Electric Railway and the Southern Pacific Company were in Lindsay recently conferring with citizens relative to the electric railway the Southern Pacific Company propose to build in this section of the valley. The men gave definite assurance that the new line would be decided upon in a short time. The line, it is stated, will tap the Southern Pacific line in this city, and run east to the El Mirador district.

IRRIGATION.

LINDSAY, CAL.—Sealed bids will be received for the construction of irrigation works for the Lindsay-Strathmore Irrigation District up to July 7th.

STOCKTON, CAL.—The bond election of the West Side Irrigation District will probably be held July 15. The estimated cost of the project is $285,000.

EUREKA, CAL.—Plans are under way for a system whereby the waters of Bull Creek can be used in the establishment of a community irrigation system.

MADERA, CAL.—Webster is to have an irrigation district, residents of the locality having voted in favor of the proposition at a recent election. E. C. Pitman is one of the directors.

TURLOCK, CAL.—Drainage is the biggest problem that is now confronting the Turlock Irrigation District. To accomplish the desired end more than one method of drainage will likely be adopted.

OSWEGO, ORE.—The Oregon Iron & Steel Company is planning an expenditure of about $400 an acre on irrigation and the installation of electricity, Bull Run water, gas and sewerage in the Dunthorp addition of 500 acres.

LAFAYETTE, CAL.—Preliminary steps have been taken here toward the formation of the Wright Irrigation District of 35,000 acres, including the present Woodbridge irrigation system. It is planned to bond the district for $300,000 to run forty years.

TERRA BELLA, CAL.—The Terra Bella Irrigation District proposes to construct a system of works to irrigate 12,500 acres of land immediately adjoining the town of Terra Bella. The source of water supply for this land will be the surface run-off of Deer Creek and deep wells located in the valley west of Terra Bella.

FRESNO, CAL.—Two additional surveyors have been sent to Pine Flats by L. A. Nares and I. Teilmann, who own the site where it is proposed to construct a reservoir to store the flood waters of Kings River. The survey is now being made to check up the capacity of the reservoir when constructed at a 300 foot level.

WILLOWS, CAL.—The Northern California Lands Company will soon begin sinking test wells for the purpose of demonstrating the existence of an adequate water supply for the irrigation of the proposed Jacinto irrigation district, which is to include about 20,000 acres of land at the north end of the Sacramento Valley irrigation project.

ANTELOPE, CAL.—Plans are under way for irrigating all of Antelope Valley, an area estimated at about 5000 acres. Engineer E. G. Hopson, formerly of the U. S. Reclamation Service, advised the land owners as to the feasibility of the project. As outlined the project will be accomplished by installing a big pumping station in the Sacramento River at some suitable point. It is estimated that 3000 inches of water will be required for an irrigation season of seven months.

PLACERVILLE, CAL.—Plans for the formation of a great irrigation district by means of which 50,000 acres of fertile land in this county will be irrigated are gaining headway, according to a report submitted to the Chamber of Commerce. The land to be irrigated extends from Clarksville to Pleasant Valley and from Webber creek to Cosumnes river. Water is to be drawn from the system of the Diamond Ridge Ditch Company.

LINDSAY, CAL.—The proposed $1,400,000 bond issue of the Lindsay-Strathmore Irrigation District was carried at the election here. Directors elected are E. L. Daniels, Charles Towt, D. A. Eskert, John Burr and F. M. Pfrimmer. C. W. Wright was chosen secretary and E. B. Gould tax collector. Work is to be started as soon as the bonds can be sold on a system to water 15,000 acres of foothill citrus lands, the contracts to be conditioned on completion of the project by the fall of 1917.